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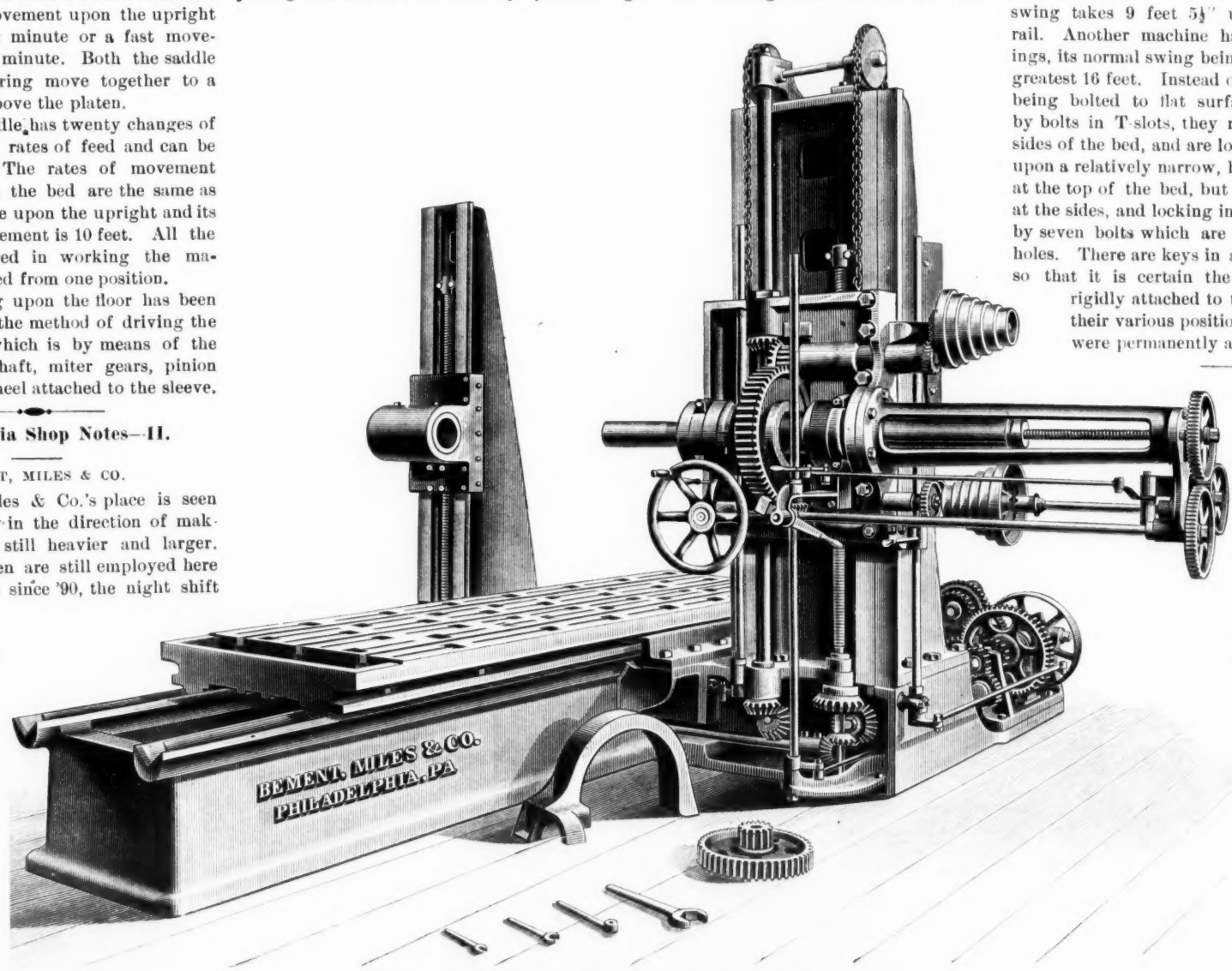
Universal Horizontal Boring and Drilling Machine.

The engraving on this page is of a recently designed boring and drilling machine built by Bement, Miles & Company, Philadelphia, Pa.

In this machine the work is mounted upon a platen which resembles that of a planing machine and which rests upon a bed of the same general form, to which however it is gibbed at both sides. The saddle is counterbalanced and has a slow movement upon the upright from 1″ to 6″ per minute or a fast movement of 6 feet per minute. Both the saddle and the outer bearing move together to a height of 5 feet above the platen.

The boring spindle has twenty changes of speed with twelve rates of feed and can be moved by hand. The rates of movement for the platen on the bed are the same as those for the saddle upon the upright and its total range of movement is 10 feet. All the movements required in working the machine are controlled from one position.

The shield lying upon the floor has been removed to show the method of driving the boring spindle, which is by means of the vertical splined shaft, miter gears, pinion and large spur wheel attached to the sleeve.



UNIVERSAL HORIZONTAL BORING AND DRILLING MACHINE.

Philadelphia Shop Notes—II.

BEMENT, MILES & CO.

At Bement, Miles & Co.'s place is seen the same tendency in the direction of making heavy work still heavier and larger. Two shifts of men are still employed here as they have been since '90, the night shift not being so numerous, however, as those employed by day. About 900 men are now employed in this establishment.

The work is mostly contracted to the men, and where, as in the case of heavy tools that must be run night and day in order to get out the work, two men are obliged to work upon the same piece, they are really made partners, both being responsible together for the proper performance of the work. The plan adopted is to agree upon a price which is to be paid for the completed work; during its progress a regular agreed-upon price per hour is paid to the workmen, and at the completion of the job they are credited in addition with the agreed upon price less what has been paid during the progress of the work. A difficulty which would naturally present itself, would be to get men working, one days and the other nights upon the job, to agree as to a fair division of the price paid for the work, when one had reason to believe that he was more capable than the other. Where complaints of this kind arise, the trouble is adjusted by a difference made in the rate of pay per hour, and it is usually practicable to put things upon a satisfactory basis in this way.

Amongst the heavier tools in process of construction were to be seen a set of plate bending rolls 32½ feet long. There are three rolls, 16″ diameter, strengthened by what is called a strong-back, which in this case is a double plate or box girder of steel, which is placed over the upper roll and parallel to it, reaching from one housing to the other, and supporting an occasional roller which bears upon and supports the roll. All the movements of the rolls in adjusting this machine are made by hydraulic power, which is a new feature in machines of this class. It is designed to bend steel plates up to 1¼″ thick.

HUGO BILGRAM.

Hugo Bilgram's business has so increased within a year or so that it has been necessary for him to take additional shop room across the street from his original place, which, however, he still retains for his jobbing work, and where he still has his office, the new quarters being devoted mainly to his regular lines of work. Among these lines that of cutting bevel gears with his special bevel gear planing machine has increased so much as to make the immediate construction of additional machines necessary. At the time of my visit he was preparing his Chicago exhibit for shipment, and this included several pairs of diagonal toothed gears which were remarkably well made. One pair of these were about 4 pitch, and had about 30 teeth 4″ long, and planed 1″ off the center. They looked oddly enough, and as though they would not work, but when put together they ran beautifully.

Among the curiosities of his exhibit are a bevel gear and pinions all working together nicely, there being three of the pinions with different numbers of teeth and different diameters, all working with the same gear and working well. This would ordinarily be considered an impossible accomplishment, and ordinarily it is impossible, but it can be done, where the teeth are planed, by using a different portion of the involute curve for the outline of the teeth. A set composed of a spur gear and three pinions which accompany the others illustrates the principle. The larger of these has 50 teeth 8 P. The pinions that work with it have 16 teeth, and one of them is of the normal diameter, while the others—the smallest and largest—vary from each other in diameter ⅛″, the fact that a different portion of the involute is used in forming the teeth showing plainly from the fact that one of them has very pointed teeth like those usually seen on a twelve-tooth pinion, while the other has very blunt teeth, apparently almost as wide at the top as at the pitch line. They seem upon trial to work with the gear about equally well, and very well.

WILLIAM SELLERS & CO.

At William Sellers & Company's, their traveling crane business is occupying a good share of their attention and shop room, in addition to which they are developing some new things in connection with the Emery testing machine, which they are now the manufacturers of.

Amongst the heavier tools in course of construction are a number of boring mills made from new patterns, and which are admirable tools. One of them of 12 feet swing takes 9 feet 5½″ under the cross-rail. Another machine has shifting housings, its normal swing being 12 feet, and its greatest 16 feet. Instead of these housings being bolted to flat surfaces, and secured by bolts in T-slots, they run down at the sides of the bed, and are locked to it, resting upon a relatively narrow, horizontal surface at the top of the bed, but extending down at the sides, and locking in various positions by seven bolts which are fitted to reamed holes. There are keys in addition to these, so that it is certain the housings are as rigidly attached to the bed in any of their various positions, as though they were permanently attached to it.

It is greatly to be regretted that neither William Sellers & Co., nor Bement, Miles & Co., are to be represented at Chicago, for while it is true that there will be heavy tools there by other builders, it does these other builders no injustice to say that without exhibits from these two firms the art of heavy tool building in this country will by no means be adequately or fairly represented. Both have been leaders in tool building—originators of types of tools, and have done very much to build up the good reputation of American tools. Whatever else an exhibition of American tools may contain, it cannot be said to be complete without specimens from these two establishments. The

ALBRO-CLEM ELEVATOR COMPANY

is a new one of Philadelphia's industrial establishments, and is at present occupying the old quarters of the Morse Elevator Company for whom Mr. Albro was machine shop foreman for about seven years. Mr. Albro is best known perhaps through his connection with the Albro Hindley worm and wheel, which derived its hyphenated name from the fact that Mr. Albro conceived the idea of the worm, and devised a method of making it, when upon investigating the history of the matter he found that Hindley, an Englishman, had years before conceived

the idea of a similar worm, though not a form which gave so good a bearing of the threads of the worm. In justice to him, however, Mr. Albro gave him credit for his invention in the naming of the improved worm, which was illustrated in our issue of April 13, and is in some form referred to in almost every modern work on mechanics that pretends to treat of the subject of worm gearing. They are made here for outside parties, and for use in the elevators built by the concern, which is equipped with a special plant of machinery for their manufacture, the wheels being hobbed upon a machine having provision for rotating the blank at the proper speed, while the threads of the worms are milled by a stem cutter which, instead of being fed along in a straight line as a lathe tool is moved, is swung upon an arc of a circle, the center of which coincides with the center of the worm-wheel with which the worm is to work. Both machines are specially designed for the work, are very heavy and powerful, and the results obtained by their use are admirable, as is plainly seen where one of these worms and its wheel have been running together for some time. The bearing surface, instead of being scored or apparently worn, seems burnished bright and smooth, this being the result partly of the relatively great bearing surface obtained, and partly from the fact that any given point upon the teeth of the wheel is subjected to sliding contact with parts of the worm thread of varying radius, so that lines upon which the rubbing occurs continually cross and recross each other, and thus scoring is effectually prevented. The teeth of the wheels made by this process are also much deeper than it is practicable to make them by the ordinary process.

F. J. M.

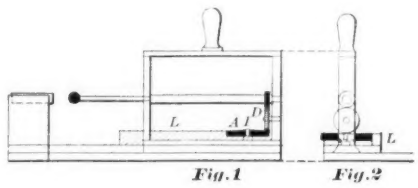


Fig. 1 Fig. 2

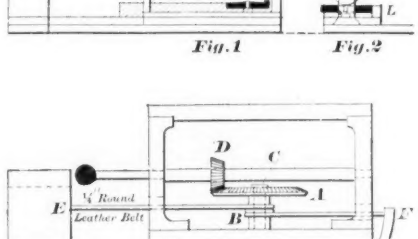


Fig. 3

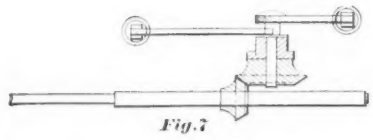


Fig. 7

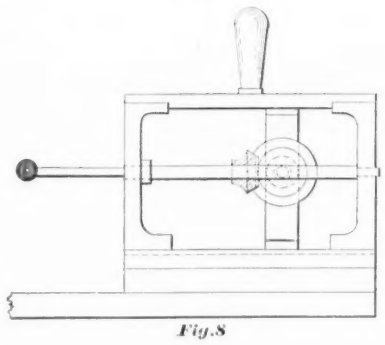


Fig. 8

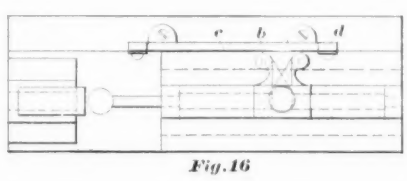


Fig. 16

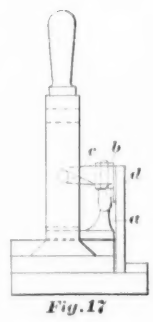


Fig. 17

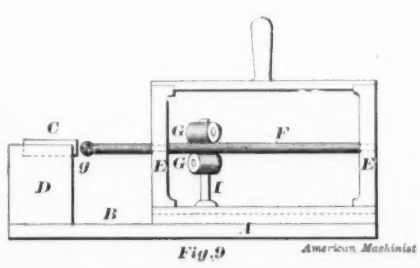


Fig. 9

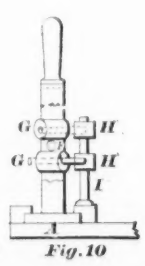


Fig. 10

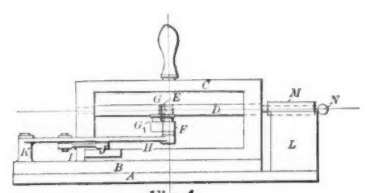


Fig. 4

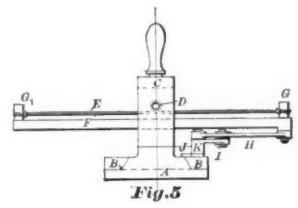


Fig. 5

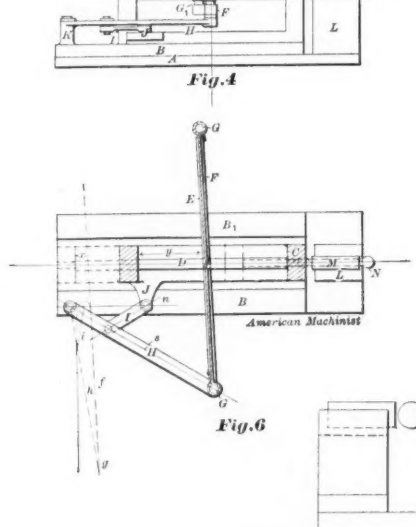


Fig. 6

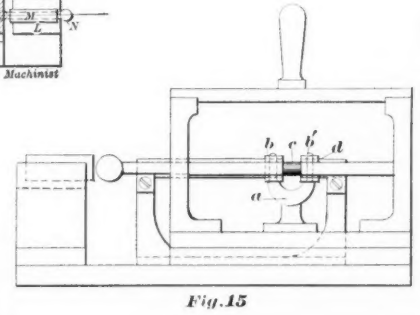


Fig. 15

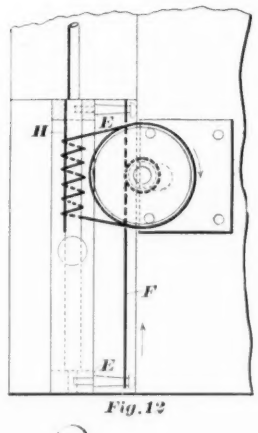


Fig. 12

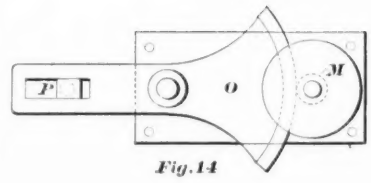


Fig. 14

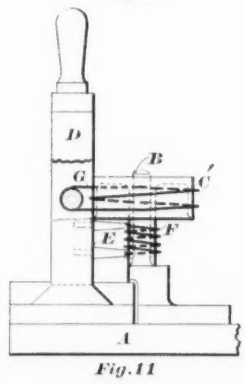


Fig. 11

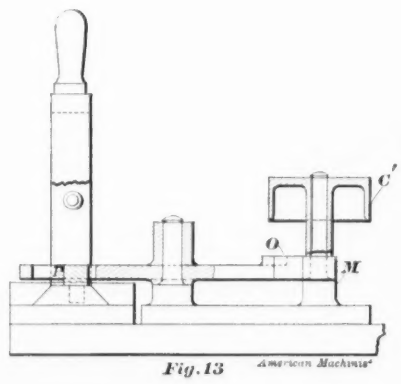


Fig. 13

On the Cultivation of Inventive Capacity by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

In the present number I shall strive to complete notices of all the solutions of the problem given out in the issue of December 29th, 1892. Either from a growing interest in these problems, or because of the character of the particular problem under consideration, a greater number of solutions of it have been sent in than were drawn out by any of the previous ones.

Mr. Byron Iselty, of Cedar Rapids, Ia., has forwarded the solution shown in Figs. 1 and 2 "In Fig. 1, *A* is a disk or friction-wheel of wood or other suitable material, and mounted on a stud *I*, which is securely set into the top side of the bottom piece of the sliding stock. On the periphery of this wheel, and also upon its upper outside edge is cemented a strip of rubber or other good friction material. To the rear upright piece of the stock is pivoted a friction-wheel of smaller diameter, whose periphery bears against the strip of rubber on the top side of the large wheel, and also on the opposite side against a strip of similar material cemented to the spindle. As the stock is moved back and forth, the periphery of the larger wheel bears against a ledge of wood *L*, which is fastened to the back edge of the base upon which the stock moves, or to the table."

This solution, while it meets all the requirements set forth in the original statement of the problem, is not so good as that of Mr. Soper, presented in the issue of March 30, as it makes no provision for increasing the velocity of rotation of the spindle. It is, however, very obvious that a slight modification of the construction will secure increase of velocity, and of the number of turns of the spindle.

The same contributor has sent in another solution, which, as it oversteps one of the restrictions by an alteration of the construction of the sliding stock, is excluded. It is, however, a good movement, and I regret that want of space prevents me from showing it, notwithstanding its divergence from the requirements laid down in the problem as originally stated.

Mr. Albert Wettengill, of St. Louis, sends two different solutions, one of which is almost identical with that of Mr. Graves, given in the issue of March 30. The other is shown in Fig. 3—an extremely simple solution, and one that meets all the requirements, but which, if the restrictions be strictly interpreted, violates one of them by making a hole through each upright part of the sliding-stock for the passage of a cord belt. However, as the solution supplies a good mechanical movement, I have concluded to give it a place notwithstanding this slight departure from the restrictions. *A* is a bevel wheel keyed to a sleeve *B*, that works on the stud *C*. The bevel gear *A* meshes with the bevel pinion *D* that is keyed to the spindle. A round leather belt passes through holes in the upright end pieces of the stock, is wound twice around the sleeve *B*, and its ends are fastened firmly at *E* and *F*. It is clear that the to and fro movement of the stock will by this arrangement impart a rapid rotary movement to the spindle, and that a considerable number of turns during each movement of the stock can be obtained by properly proportioning the parts.

Mr. Charles P. Smith, of Lynn, Mass., sends a solution which supplies an entirely unique movement for the purpose. Mr. Smith writes in explanation of the drawings, Figs. 4, 5 and 6, that "the parts added are the lug *J* made a part of *C*; links *I* and *H*, and bar *F*; and the cord *E*, stretched tightly from the posts *G*, *G* and wound about *D*. This apparently introduces three or four additional parts to accomplish the rotation of the shaft while the carriage *C* is moved back and forth."

I cannot see, except by a relaxation of the restrictions, how the lug *J* can consistently be made a part of the carriage *C*; but, as it could be made separate and then attached, this objection might be waived. If so, however, the number of parts permitted will be exceeded by one part. I will not, however, in this case press these points.

Mr. Smith gives the following very clear description of the operation of the movement.

"The carriage is shown at one end of its motion with the swab *N* pushed through the tube *M*. When the carriage is moved to the other end of its stroke, it takes the position shown in dotted lines, and the links and bar *I*, *H* and *F* take the positions *i*, *h* and *f*. The point *G* travels to *g*, and the cord *E* is drawn slightly obliquely around the spindle, causing it to rotate nearly three turns. The cord during rotation will naturally advance toward the end of the carriage, diminishing distance *y* to *x*. The lever *H* is made more than twice the length of *I*, to make this advance of the point *G* correspond with the screw action of the cord on the spindle.

"If the point *G* were at *s*, then the pull of the cord would be exactly at right angles to the motion of the carriage, the point *s* being always in a line at right angles to the center line, and passing through the point *n*.

"The proportion of the links may evidently be changed to give more or less rotation to the spindle.

"The bar *F* will sag some, due to its weight. To correct this, the spindle should be placed higher and the cord will then support the bar, and with a little freedom in the hinge at *G* would not impair the action."

The spindle in Mr. Smith's movement can be made to rotate at high velocity and make a good number of full turns at each reciprocation of the stock, and the attached parts may be made very light.

A neat solution, shown in Figs. 7 and 8, has been furnished by Mr. Frank A. Risdon, of Waterbury, Conn. Mr. Risdon writes as follows:

"In order to get a positive motion, I have used bevel gears, one of which is fast on the spindle, and the other at right angles on a shaft, at the other end of which is a small pulley. To this pulley is fastened two thin straps of steel, the other ends of which straps are fastened to two studs that are set stationary in the base. You will see that by moving the stock forward one belt will be unwound from the pulley, while at the same time the spindle shaft will be revolved, and the other strap will be wound on. By moving the stock backward the movements will be reversed."

Mr. Alfred E. Johnson sends in a solution, and writes from Carson (State inadvertently omitted, but I presume Nevada,) as follows, referring to Figs. 9 and 10, that illustrate his solution:

"In evidence that the interest in your mechanical problems is not confined to the Eastern States, I submit the inclosed solution of your problem of December 29th. It is one of several solutions that I have worked out that seem to fulfill the conditions of the problem, and is only selected from the others because it has cost me the most study to develop. In the inclosed sketch, Fig. 9 is a side elevation, and Fig. 10 an end elevation, showing the construction of a swabbing machine as you propose, in which *A* is the table, *B* an iron plate, *C* brass tube, *D* support for the same, *E E* sliding frame, *F* spindle, *g* sponge and *G G* two rollers set at

opposite angles, one above and one below the spindle. These rollers revolve freely on, and are supported by arms *H H*, and column *I* secured to the table. In operation, as the spindle *F* is moved longitudinally in contact with rollers *G G*, it causes them to revolve at a rate of speed proportioned to the angle of contact with the spindle, at the same time acting to revolve the spindle at a rate governed by the size of the spindle and angle of contact with the rollers."

A very rapid rotation of the spindle, and a considerable number of turns will be effected by a device shown in Figs. 11 and 12, contributed by Mr. Herman Oberg, of Watertown, N. Y I copy Mr. Oberg's description.

"On the bench *A*, Figs. 11 and 12, is mounted the stud *B*, on which pulley *C* revolves freely. In each of the uprights of the stock *D*, a projecting pin *E* is inserted. A belt *F* of square cross-section is wound a few times around the hub of the pulley *C*, and its ends then fastened to pins *E*, so as to keep it taut. An endless belt *G*, also of square cross-section, is wound several times around the spindle *H*, and one complete turn around pulley *C*, as indicated in Figs. 11 and 12.

"Let *T* represent travel of carriage.

n represent number of revolutions per single stroke of carriage.

d represent diameter of spindle.

t represent thickness of belts.

D represent diameter of pulley *C*.

N represent number of revolutions of pulley *C* per single stroke.

D' represent diameter of hub of pulley *C*.

"Then if *T*, *n*, *d*, *t* and *D* are given, $N = \frac{d+t}{D+t} n$, and $D' = \frac{T - N\pi t}{N\pi}$.

"The pitch of the belt-coil on the spindle should, as nearly as possible, approach the value $\frac{T}{n}$.

"In the sketch the stock is shown in its hindmost position. Now, if it be slid forward the belt *F* will cause the pulley *C* to revolve, which, in connection with the belt *G*, will revolve the spindle *H*. As the stock advances the driving part of the belt *G* is unwound from the spindle while the slack part is wound on.

"In this construction I have used *two* pins for connection, which, as I take it, is not strictly in accordance with the statement of the problem; I therefore also submit a modification of this construction shown in Figs. 13 and 14.

"The pulley *C* and its connection with the spindle are similar to that in Figs. 11 and 12, except that the belt *G* does not take so many turns around the spindle, and is wound in an opposite direction. The pulley *C* also carries a pinion *M* which is in mesh with the gear segment *O*, the slotted arm of which is connected with the carriage by means of the square-headed pin *P* that works freely in a hole drilled in the base of the carriage.

"If the length of the slotted arm of the gear segment, and also the diameter of pulley *C* be increased the motion of spindle may be made less irregular if desired."

In Figs. 15, 16 and 17 are shown a solution contributed by Mr. Jos. E. Martin, of Orange, N. J. Fig. 15 is a side elevation, Fig. 16 a plan, and Fig. 17 an end view of this device. A support *a* for the idler pulleys *b b'* is attached to, and travels with the sliding stock. A quarter-turn belt *c* passes over the shaft of the sponge spindle, thence around the idlers, and is fastened at each of its ends by clamps *d* to the base of the machine. Of course, the sliding of the stock will cause the spindle to revolve, the rapidity of rotation and number of turns depending on the ratio of the diameter of the spindle shaft to the distance through which the stock moves.

Mr. Robt. W. Boenig, M. E., of Brooklyn, N. Y., has sent in two solutions, but they appear, each of them, to exceed the limit of the number of parts that were permitted to be added to effect the desired movement. They are, however, both operative, and one of them is entirely different from any others that have been sent in.

Mr. Edward Hosmer, of Michigan City, Ind., has sent in a solution which embodies substantially the same principle, and substantially the same construction as that of Mr. Gribben's second solution, printed in issue of February 23.

Mr. Elmer E. Page, Providence, R. I., has sent in a solution that while it is operative includes unmistakably a bell-crank movement, excluded in the limitations of the problem.

Mr. C. S. Clark, of Altoona, Pa., has contributed a solution substantially like that of Mr. Cowley, printed in issue of February 23, except that he uses a flat quarter-twist belt instead of a round or cord belt.

Mr. W. F. Torrey, of Auburn, R. I., has sent a solution which effects the desired movement, but which violates the restriction that no alteration is permissible in the construction of the slide.

Mr. John W. Brodhead, of Providence, R. I., has my thanks for a suggestion made in a letter accompanying drawings in a solution sent by him, which solution I regret that I must reject for the same reason as assigned for the rejection of Mr. Torrey's.

Mr. R. T. Wingo, of Providence, R. I., has contributed a correct solution, substantially like that of Mr. Casebolt, shown in Figs. 15, 16 and 17 in issue of April 13.

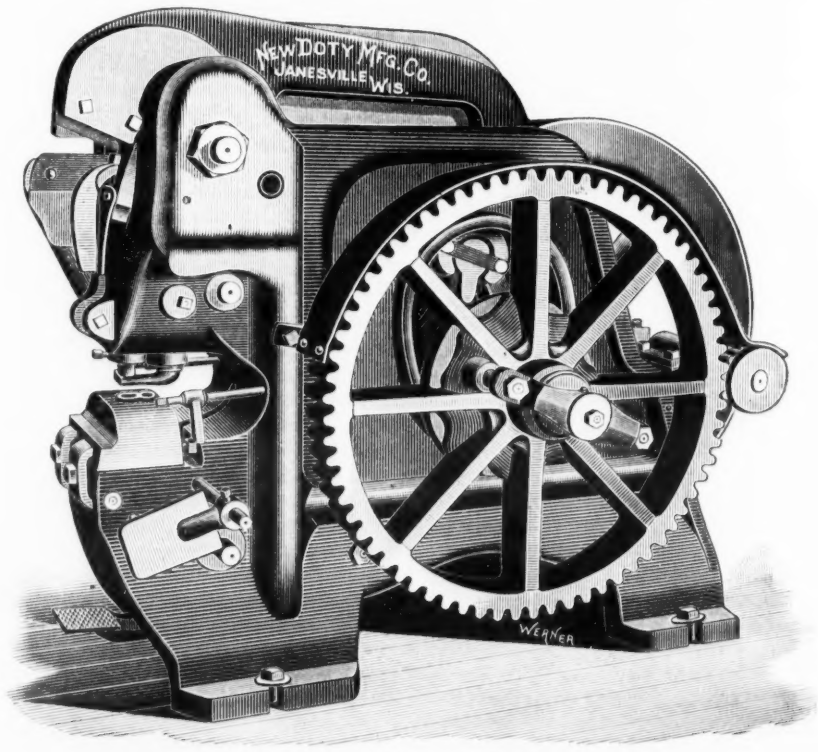
These complete the notices of all solutions contributed to the problem of the swabbing machine, and so conclude the present further consideration of that problem.

Combined Punch and Shear.

We give with this an illustration of a combined punch and shear made by the New Doty Manufacturing Company of Janesville, Wis.

The punch and shears for flat bars and those for round bars are entirely separate and can be used independently of each other. The capacity of the machine is to punch a 1" hole in ⅝" iron; to cut ⅝"x4" bar iron, or 1½" round iron, and any of these operations can be performed without change in the machine.

The frame is in two parts which are planed together and secured by taper bolts. The



COMBINED PUNCH AND SHEAR.

boxes are cast solid with the frame, and the eccentric, shaft and clutch are all cast solidly together, the aim being to make the machine of as few parts as possible.

Tight and loose pulleys are on the machine and it can, of course, also be stopped or started by the clutch controlled by treadle.

The Iron and Steel Institute of Great Britain has awarded to Mr. John Fritz, chief engineer of the Bethlehem Iron Company, the Bessemer medal for distinguished services to the art of iron and steel manufacture and working.

Stover Friction Drill.

We show with this a drilling machine made by Stover Novelty Works, Freeport, Ill., to drill holes up to $\frac{5}{16}$" diameter and to center of a 10" circle. It will be seen by an

inspection of the engraving that as the speed of the spindle is decreased, as when the larger sizes of drills are being used, the twisting or turning effect on the drill is correspondingly increased, and on the contrary, when the speed of the spindle is increased, for small drills, the twisting effect on the drill is decreased, thus providing against the breaking of drills.

The platen can be raised and lowered from one extremity to the other by five turns of the crank; the speed can be instantly changed by the use of one hand while the other hand is employed in holding the work. Stopping and starting is done by the foot.

Some of the dimensions are: Greatest height from platen to spindle, 35"; greatest height from base to spindle, 46½"; distance from column to spindle, 5"; diameter of column, 3¾"; diameter of spindle, ¾"; size of table, 10"x14"; vertical motion of spindle, 3½".

Spindle fitted for No. 1 Morse taper. The machine is also arranged to be used on a bench or post when required.

Strength of Various Materials—Extracts from Kirkaldy's Tests—II.*

BY WILLIAM KENT.

SPRING STEEL.—Untempered, 6 tests, average, E. L., 67,916; T. S., 115,668; contr., 37.8; ext. in 10 inches, 16.6. Spring steel untempered, 15 tests, average, E. L., 38,785; T. S., 69,496; contr., 19.1; ext. in 10 inches, 29.8. These two lots were shipped for the same purpose, viz., railway carriage leaf springs.

STEEL CASTINGS.—44 tests, E. L., 31,816 to 35,567; T. S., 54,928 to 63,840; contr., 1.67 to 15 8; ext., 1.45 to 15.1. Note the great variation in ductility. The steel of the highest strength was also the most ductile.

PULLING TESTS OF RIVETED STEEL PLATES, TRIPLE RIVETED LAP JOINTS, MACHINE RIVETED. HOLES DRILLED.

RIVETED JOINTS.

Plates, width and thickness, inches.	13.50 × .25	13.00 × .51	11.75 × .78	12.25 × 1.01	14.00 × .77
Plates, gross sectional area square inches	3.375	6.63	9.165	12.372	10.780
Stress, total, pounds	190,320	332,640	423,180	528,000	435,210
Stress per square inch of gross area, joint	59,058	50.172	46.173	42.696	42.327
Stress per square inch of plates.	70,765	65,300	64,050	62,280	68,045
Ratio of strength of joint to solid plate	83.46	75.83	72.09	68.55	62.06
Ratio net area of plate to gross	73.4	65.5	62 7	64.7	72.9
Where fractured	plate at holes.	plate at holes.	plate at holes.	plate at holes.	rivets sheared.
Rivets, diameter, area and number.	.45, 159, 24	.64, 321, 21	.65, 708, 12	1.08, 916, 12	.95, 708, 12
Rivets, total area	3.816	6.741	8.496	10.992	8 496

STRENGTH OF WELDS.—Tensile tests to determine ratio of strength of weld to solid bar.

IRON TIE BARS.—28 Tests.

Strength of solid bars varied from	43, 201 to 57,065 lbs.
Strength of welded bars varied from	17,816 to 44,586 lbs.
Ratio of weld to solid varied from	37.0 to 79.1 %

IRON PLATES.—7 Tests.

Strength of solid plate from	44,851 to 47,481 lbs.
Strength of welded plate from	26,442 to 38,931 lbs.
Ratio of weld to solid	57.7 to 83.9 %

CHAIN LINKS.—216 Tests.

Strength of solid bar from	49,122 to 57,875 lbs.
Strength of welded bar from	39,575 to 48,824 lbs.
Ratio of weld to solid	72 1 to 95.4 %

IRON BARS.—Hand and Electric Machine Welded.

32 tests, solid iron, average	52,444	
17 " electric welded "	46,836	ratio 89.1 %
19 " hand " "	46,899	" 89.3 %

STEEL BARS AND PLATES.—14 Tests.

Strength of solid	54,226 to 64,580
Strength of weld	28,553 to 46,019
Ratio weld to solid	52.6 to 82.1 %

The ratio of weld to solid in all the tests ranging from 37.0 to 95.4 is proof of the great variation of workmanship in welding.

SCREWED BOLTS.—Ratio of Strength of Threaded to Solid Portion of Bolts. 28 Steel Bolts.

Strength of solid portion	57,456 to 93,060
Strength of threaded portion	41,055 to 73,189
Ratio of screw to solid	54.5 to 88.8 %

109 IRON BOLTS.

Strength of solid portion	44,485 to 66,118
Strength of threaded portion	32,053 to 46,782
Ratio of screw to solid	61.7 to 88.2%

CAST COPPER.—4 tests, average, E. L., 5,900; T. S., 24,781; contr., 24.5; ext., 2.18.

COPPER PLATES.—As rolled, 22 tests, 26 to .75 in. thick; E. L., 9,766 to 18,650; T. S., 30,993 to 34,281; contr., 31.1 to 57.6; ext., 39.9 to 52.2. The variation in elastic limit is due to difference in the heat at which the plates were finished. Annealing reduces

* Strength and Properties of Materials with Description of System of Testing. By W. G. Kirkaldy. D. Van Nostrand Company, New York.

the T. S. only about 1,000 pounds, but the E. L. from 3,000 to 7,000 pounds.

Copper Plates.—148 tests (another series, .38 to .52 thick); T. S., 29,099 to 31,924; contr., 28.7 to 56.7; ext. in 10 inches, 28.1 to 41.8. Note the uniformity in tensile strength.

Drawn Copper.—74 tests (0.88 to 1.08 inch diameter); T. S., 31,634 to 40,557; contr., 37.5 to 64.1; ext. in 10 inches, 5.8 to 48.2.

Ferro Bronze.—Tensile tests, 3 bars each, soft rolled and hard rolled. Hard rolled, E. L., 19,100 to 36,300; T. S., 60,265 to 74,485; contr., 28.4 to 35.6; ext. in 10 inches, 30.8 to 38.2. Soft rolled, E. L., 16,800 to 17,600; T. S., 62,935 to 67,985; contr., 27.3 to 30.5; ext. in 10 inches, 28.6 to 36.1. 4 castings, E. L., 17,400; to 22,700 T. S., 25,565 to 29,310; contr., 1.5 to 26.1; ext. in 10 inches, 0.3 to 9.8. Shearing stress of the rolled bronzes was from 56.9 to 63.4 per cent. of the pulling stress, while that of the castings was from 87.9 to 110.6 per cent.

Bronze from a Propeller Blade.—Means of two tests each from center and edge. (Central portion sp. gr. 8.320.) E. L., 7,550; T. S., 26,312; contr., 25.4; ext. in 10 inches, 32 8. (Edge portion sp. gr. 8.550.) E. L., 8,950; T. S., 35,960; contr., 37.8; ext. in 10 inches, 47.9.

Cast German Silver.—10 tests. E. L., 13,400 to 29,100; T. S., 23,714 to 46,540; contr., 3.2 to 21.5; ext. in 10 inches, 0.6 to 10.2.

Thin Sheet Metal.—Tensile Strength.

German silver, 2 lots	75,816 to 87,129
Bronze, 4 lots	73,380 to 92,086
Brass, 2 lots	44,398 to 58,188
Copper, 9 lots	30,470 to 48,450
Iron, 13 lots, lengthway	44,331 to 59,484
Iron, 13 lots, cro-sway	39,838 to 57,350
Steel, 6 lots	49,253 to 78,251
Steel, 6 lots, crossway	55,948 to 80,769

Wire.

German silver, 5 lots	81,735 to 92,224
Bronze, 1 lot	78,049
Brass, as drawn, 4 lots	81,114 to 98,578
Copper, as drawn, 3 lots	37,607 to 46,494
Copper annealed, 3 lots	34,936 to 45,210
Copper (another lot,) 4 lots	35,052 to 62,190
Copper (extension 36.4 to 0.6%).	
Iron, 8 lots	59,241 to 97,908
Iron (extension 15.1 to 0.7%).	
Steel, 8 lots	103,272 to 318,823

The steel of 318,823 T. S. was .047 inch diam. and had an extension of only 0.3 per cent.; that of 103,272 T. S. was .107 inch diam. and had an extension of 2.2 per cent. One lot of .044 inch diam. had 267,114 T. S., and 5.2 per cent. extension.

pounds, or 2,474 to 3,346 pounds per fathom weight.

Manila Ropes.—35 tests, 1.19 to 8.90 inches circumference, 0 20 to 11.40 pounds per fathom. Strength 1,280 to 65,550 pounds, or 3,003 to 7,394 pounds per fathom weight.

Belting.

No. of lots.		Tensile strength per square inch.
11	Leather, single, ordinary tanned	3,248 to 4,824
4	Leather, single, Helvetia	5,631 to 5,944
7	Leather, double, ordinary tanned.	2,160 to 3,572
8	Leather, double Helvetia	4,078 to 5,412
6	Cotton, solid woven	5,648 to 8,869
14	Cotton, folded, stitched	4,570 to 7,750
1	Flax, solid, woven	9,946
1	Flax, folded, stitched	6,389
6	Hair, solid, woven	3,852 to 5,159
2	Rubber, solid, woven	4,271 to 4,343

Canvas.—35 lots. Strength, lengthwise, 113 to 408 pounds per inch; crossways, 191 to 468 pounds per inch.

The grades are numbered 1 to 6, but the weights are not given. The strengths vary considerably, even in the same number.

Marbles.—Crushing strength of various marbles. 38 tests, 8 kinds. Specimens were 6 inch cubes or columns 4 to 6 inches diameter, and 6 and 12 inches high. Range 7,542 to 13,720 pounds per square inch.

Granite.—Crushing strength, 17 tests; square columns 4x4 and 6x4, 4 to 24 inches high, 3 kinds. Crushing strength ranges 10,026 to 13,271 pounds per square inch. (Very uniform.)

Stones.—(Probably sandstone, local names only given.) 11 kinds, 42 tests, 6x6, columns 12, 18 and 24 inches high. Crushing strength ranges from 2,105 to 12,122. The strength of the column 24 inches long is generally from 10 to 20 per cent less than that of the 6 inch cube.

Stones.—(Probably sandstone) tested for London & Northwestern Railway 16 lots, 3 to 6 tests in a lot. Mean results of each lot ranged from 3,785 to 11,956 pounds. The variation is chiefly due to the stones being from different lots. The different specimens in each lot gave results which generally agreed with 30 per cent. An exceptionally large variation is seen in one lot of six specimens, ranging from 9,347 to 6,192 pounds per square inch.

Bricks.—Crushing strength, 8 lots; 6 tests in each lot; mean results ranged from 1,835 to 9,209 pounds per square inch. The maximum variation in the specimens of one lot was over 100 per cent. of the lowest. In the most uniform lot the variation was less than 20 per cent.

WIRE ROPES.

SELECTED TESTS SHOWING RANGE OF VARIATION.

Description.	Circumference inches.	Weight per fathom.	Strands. No. of Strands.	Strands. No. of Wires.	Diam. of wires inches.	Hemp Core	Ultimate Strength Pounds.
Galvanized	7.70	53.00	6	19	.1563	Main	339,780
Ungalvanized	7.00	53.10	7	19	.1495	Main and Strands	314,860
Ungalvanized	6.38	42.50	7	19	.1347	Wire Core	295,920
Galvanized	7.10	37.57	6	30	.1004	Main and Strands	272,750
Ungalvanized	6.18	40.46	7	19	.1302	Wire Core	268,470
Ungalvanized	6.19	40.33	7	19	.1316	Wire Core	221,820
Galvanized	4.92	20.86	6	30	.0728	Main and Strands	190,890
Galvanized	5.36	18.94	6	12	.1104	Main and Strands	136,550
Galvanized	4.82	21.50	6	7	.1693	Main	129,710
Ungalvanized	3.65	12.21	6	19	.0755	Main	110,180
Ungalvanized	3.50	12.65	7	7	.122	Wire Core	101,440
Ungalvanized	3.82	14.12	6	7	.135	Main	98,670
Galvanized	4.11	11.35	6	12	.080	Main and Strands	75,110
Galvanized	3.31	7.27	6	12	.068	Main and Strands	55,095
Ungalvanized	3.02	8.62	6	7	.105	Main	49,555
Ungalvanized	2.68	6.26	6	6	.0963	Main and Strands	41,205
Galvanized	2.87	5.43	6	12	.0560	Main and Strands	38,555
Galvanized	2.46	3.85	6	12	.0472	Main and Strands	28,075
Ungalvanized	1.75	2.80	6	7	.0619	Main	24,552
Galvanized	2.04	2.72	6	12	.0378	Main and Strands	20,415
Galvanized	1.76	1.85	6	12	.0305	Main	14,634

Hemp Ropes, Untarred.—15 tests of ropes from 1.53 to 6.90 inches circumference, weighing 0.42 to 7.77 pounds per fathom, showed an ultimate strength of from 1,670 to 33,808 pounds, the strength per fathom weight varying from 2,872 to 5,534 pounds.

Hemp Ropes, Tarred.—15 tests of ropes from 1.44 to 7.12 inches circumference, weighing from 0.38 to 10.39 pounds per fathom, showed an ultimate strength of from 1,046 to 21,549 pounds, the strength per fathom weight varying from 1,767 to 5,149 pounds.

Cotton Ropes.—5 ropes, 2.48 to 6.51 inches circumference, 1.08 to 8.17 pounds per fathom. Strength 3,089 to 23,258

Portland Cement.—(Austrian.) Cross-sections of specimens 2x2½ inches for pulling tests only; cubes, 3x3 inches for thrusting tests; weight, 98 8 pounds per imperial bushel; residue, 0.7 per cent., with sieve 2,500 meshes per square inch; 38.8 per cent. by volume of water required for mixing; time of setting, 7 days; 10 tests to each lot.

Mean Results.

Age	Cement alone Pulling	Cement alone Thrust'g	1 Cem't 2 sand Thrust'g	1 Cem't 3 sand Thrust'g	1 Cem't 4 sand Thrust'g
10 days	376	2,910	893	407	228
20 days	420	3,342	1,024	494	275
30 days	451	3,724	1,172	594	338

Portland Cement.—Various samples pulling tests, 2x2½ inches cross-section, all aged 10 days, 180 tests; ranges 87 to 643 pounds per square inch.

Wood.—Transverse and Thrusting Tests.

Tests.	Sizes abt. in sq.	Span, inches.	Ultimate Stress.	$S = \frac{L\,W}{4\,B\,D^2}$	Thrusting Stress per sq. in.
Pitch pine 10	11½ to 12½	144	45,856 to 80,520	1,096 to 1,403	3,586 to 5,438
Dantzic fir 12	12 to 18	144	37,948 to 54,152	657 to 790	2,478 to 3,423
English oak 3	4½ x 12	120	32,856 to 39,084	1,505 to 1,779	2,473 to 4,437
American white oak 5	4½ x 12	120	23,624 to 26,952	1,190 to 1,372	2,656 to 3,899
Demerara greenheart, 9 tests					8,169 to 10,785
Oregon pine, 2 tests					5,888 and 7,284
Honduras mahogany, 1 test					6,769
Tobasco mahogany, 1 test					5,978
Norway spruce, 2 tests					5,259 and 5,494
American yellow pine, 2 tests					3,876 and 3,983
English ash, 1 test					3,025

Recent Developments in the Electrical Transmission of Power.*

By C. J. H. Woodbury, Lynn, Mass.

Since the last meeting of this association, the Board of Government recognizing the importance to the cotton manufacturing interests of questions pertaining to the electrical transmission of power, and foreseeing the greater importance which this method is likely to assume, have thought it advisable to continue the consideration of this subject at the present meeting; and in accordance with their invitation I beg to deviate somewhat from my former papers on electrical subjects, and instead of confining myself entirely to practical results, to give a little attention to some of the main principles involved, which will soon be as necessary a part of the knowledge of every manufacturer as the principles involved in water wheels and steam engines are at the present time.

In the ordinary dynamo for electric lighting, each of the various coils of wire making up a section of the armature is brought into the circuit as its commutator bar comes in contact with the brush, and in that manner contributes to the circuit for electric lighting or power the current of electricity which it has produced by being pulled across the attraction of the magnets of the dynamo.

In the reverse manner, if electricity were applied to such a dynamo, it would energize the magnets, pass through the wires of the armature, and the attraction of the magnets would cause this armature to revolve, or convert the dynamo into a motor, because the magnet attracts each coil of the armature, and as it moves around to proximity to the poles of the magnet the electricity is switched out of such coils by the commutator, and the magnet exerts no further attraction upon that coil, but is ready to exercise a similar attraction for the next section, for it must be remembered that the attraction which the magnet exerts is not upon the wires of the armature, for they are made of copper, but upon the current of electricity conveyed by these wires. A current of electricity is subject to magnetic attraction similar to iron, as may be seen by applying a magnet to a lighted incandescent lamp. The carbon filament is readily bent as if it were a very fine iron wire, but if the lamp is not lighted, the carbon filament is not affected by the magnet.

The question naturally arises: Why should not iron or steel wires be used in the armature? The one sufficient reason is that the magnets would attract a section of wire in the armature and would hold it stationary. Whereas when the attraction is exerted upon a current of electricity in the coil of wire in the armature, that principle can be used to produce a motion by the ready manner in which the electricity can be conducted through or removed from any coil of iron in the armature to meet the mechanical necessities of the case to produce a rotation of this armature.

I have gone into this matter at some length in order to state the principle of the ordinary continuous current motors, which is that the magnet remains stationary, and that the electrical currents are moved from one set of wires to another in the armature as occasion requires.

In the dynamo the electricity is generated in the armature in currents passing to and fro, first in one direction and then in the other, forming what is known as the alternating current. The function of the commutator and the brushes upon a dynamo is merely to convert this alternating current into a continuous current. There is no reason why an alternating current is not just as well suited for electric lighting as a continuous current.

But many years ago when Sir Frederick Siemens, one of the pioneers in the application of electricity, made a dynamo for arc lighting, he required a continuous current to operate the regulator in the upper part of his arc lamps, and instead of trying to invent a form of regulator to feed the carbons which could be operated by an alternating current, he placed the commutator and brushes on the dynamo, producing a continuous current, and in that manner set for years the practice of electric lighting by continuous currents, although in the meantime there have been numerous devices for regulating the carbon feeding mechanism of arc lamps by alternating currents.

Electricians have of late years begun at the place from which they were diverted a number of years ago to investigate and apply alternating currents for lighting and power purposes. These investigations have opened up a wealth of electrical principles and applications, of which the world has but just seen the beginning.

One of these new forms of alternating currents is what is called the multiphase current, of which the electricity is generated in waves; one wave following another before the first wave has been completed, using currents of electricity which will affect other apparatus by induction through space and without the intervention of metallic conductors, being as a matter of principle comparable to the results produced upon a telephone system when it receives by induction the noise of electric motors or the click of the messages transmitted along telegraph wires in juxtaposition to the telephone wires, or even the voice which is transmitted over other telephone wires.

In its application to these multiphase motors I would say that the method of construction differs entirely from the motors hitherto in use. Instead of using commutator and brushes to transfer electricity from one part of the armature to the other, as has been already alluded to in the continuous current motors, the magnetism revolves through the magnet, causing the armature to revolve in exact synchronism with it.

For purposes of comparison the general arrangement of these motors may be compared to that of a hat rim, as representing the circular magnet, and a ball of twine stands for the armature on the inside, which is a suitably-wound collection of insulated wires joined together at the ends and not electrically connected to anything else. Electric wires from the generators are wound upon this circular magnet, and the wave-like currents which the wires carry produce similar magnetization traveling around and around through the magnet; and by this inductive effect to which I made allusion, electric currents are produced in the wires of the armature, so that it will be susceptible to the attraction of the magnet. The wires in the armature revolve, following the attraction of the magnetism circulating in the magnet.

Dynamos similar in principle produce the waves of current which supply this motor, but for economy in transmission, both as regards the small amount of wire and the small loss by resistance, these currents can be generated at a high electrical pressure, which is increased by transformers for the main wires, and then at the motors reduced to a very low pressure by transformers, which answer the same purpose as the reducing valve for steam, except that they can

*Read before the New England Cotton Manufacturers Association.

act in either direction to increase or reduce the electrical pressure.

The other advantages of these multiphase motors are that being without any brushes or commutators, there is no sparking. There is hardly a possibility of a burned armature. The motor being operated by a succession of wave currents will keep at a speed comparable to that of the generator as long as it can keep up. If overloaded, it will not run slower, but will stop. Under similar conditions of overloading, a continuous current motor will burn its armature, unless defended by its safety fuses. Its regulation is very close; the variability of some tests being only one and one half per cent. between no load and its full load. Such a motor will start under its full load or even a greater.

In connection with such a system of electrical transmission of power, it is feasible to use a portion of the current for incandescent lighting without any interference. These motors can be stopped and started without the exercise of any particular skill, and can be inclosed for protection against dust and dirt in a case which merely allows for the protrusion of the shafting carrying the driving pulley.

These types of motors, although new, have received thorough applications and exhaustive tests in the works of the electric companies engaged in their manufacture. It is, however, scarcely time for their use in commercial lines in this country, but they will be very fully exhibited at Chicago.

It is this type of electrical apparatus which will be used in transmitting the power from Sewall's Falls on the Merrimac River, about four miles north of Concord, for power and lighting throughout the city of Concord, and also to any establishments which may be built on the large tract of land in the vicinity owned by that company. There is a capacity of 5,000 horse-power at this point, and it is expected that 3,300 horse-power will be distributed during the early summer.

The uses of electric motors in connection with the transmission of power are becoming more widely extended, one of the best examples in this vicinity being that of the Page Belting Company, at Concord, N. H., where the power is distributed throughout their extensive new establishment by means of electric motors, for which the electricity is generated in the original works of this company. Mr. George F. Page, the president, informs me that the whole cost of the electrical apparatus was 20 per cent. less than would have been required for a steam plant applied in the usual manner. There is a further economy, by reason of the elimination of much of the shafting required in connection with the transmission of power from numerous motors in comparison with the shafting and pulleys which would have been required to distribute the power from a steam engine on the premises. The largest shafting now in these works is 2½ inches in diameter; but if an engine had been used the main shafting would necessarily have been at least 5 inches in diameter, and the length of shafting many times greater than at present, the difference in this respect being greater than in cotton manufacturing on account of the greater distance between the various machines.

In addition to safety and convenience, it may be interesting to note that this method of transmission has been carried out in such a way that there is not a single open hole through the floor for any purpose, the openings for the steam pipes being packed around with asbestos. This transmission of the power from the old works is only temporary, as it is proposed to connect with the electrical power derived from the water wheels at Sewall's Falls, as soon as that installation is completed.

I have been informed that at a new cotton-mill in South Carolina the power will be transmitted by wire to a motor driving the line shafting in each room.

One of the latest applications of the electrical transmission of power is in the Crocker-Wheeler Electric Works, at Ampere, N. J., where a pair of copper rods answer as line shafting, and from these the connections are made at will to motors operating machine tools in various parts of the establishment. In some instances it has been preferable to drive short lines of shafting by motors, and to belt down in the usual way. In the former case, the motor is attached directly to the machine, as for example, under the headstock of a lathe, and in place of using the cone pulleys for variation in speed, or the clutch for reversing the direction of the motion, the lathe is controlled by the operator in a manner comparable to the usual way in which the motorneer of a street car controls the speed or direction of the car; and from these same wires at every machine an incandescent lamp suitably protected by wire guards is used whenever artificial light is necessary, and such a light can be placed on the carriage, or wherever it may be desirable to apply the light for the purpose of the work in hand.

The operation of a calico printing machine probably presents the greatest difficulties in the application of power of any machinery in textile manufacture. The machine must be driven at will with variable speed, and any shock in the graduation from one speed to another may impair either the machine or the product. The cloth must be moved at times to a slight extent in either direction, and the whole must be absolutely under the control of the operator. As an absolute statement these requirements are almost an ideality. Up to the present time a double cylinder steam engine to each machine has furnished the best method of driving, notwithstanding that the heat and the floor area occupied by the steam engine are necessarily an interference in the printing room. When the printing machine stops, the rolls sink into the blanket, and it requires an excess of power to start it, as if it were a heavily loaded team on a soft road.

A recent application of electric motors has given practical results of the greatest importance in operating printing machines at the Dunnell Print Works in Pawtucket. At the time of their reconstruction after their late fire, about two years ago, Mr. W. W. Dunnell, wishing that the new print works should contain all of the improvements possible in the business, considered favorably the suggestion that electric motors should be tried for the operation of printing machines. A motor was applied to a seven-roll printing machine in order to give the matter a thorough trial.

This work was undertaken in spite of the skepticism of his associates and the opposition of the men engaged in the printing room. There were some difficulties at first, primarily owing to the fact that the electricians were not calico printers, as well as that the printers were not electricians. It required a little time for each to learn of the other; but since the several modifications in the arrangement for this work were introduced, the operation of the system has been not merely satisfactory, but has given results in advance of any other method of driving a printing machine.

In the electric lighting station of the works an Edison lighting dynamo with a separate exciter is used for generating a current to drive a motor which was placed on the unused portion, next to the rail, of the mezzanine floor, or what is known in the printing room as the platform. For speed and direction it is controlled by a hand wheel and switch at the front of the printing machine.

This device has had a practical trial of eighteen months duration with the most satisfactory results. By its uniformity in rotation the cloth is printed at 50 per cent. greater speed than with the steam engines in the same room. The driving is under absolute control. The cloth can be moved at will for a short distance, as an inch, if necessary. There is an absolute gradation of speed from one velocity to another, and that without any shock. These changes are so uniform that the doctor never cuts into the copper roll. The speed can be kept uniform at any desired velocity, and the machine can be stopped and started by anybody working at it. In its operation it does not require the exercise of any technical skill.

I have alluded to the maximum speed as 50 per cent. greater than with the steam engine. The uniformity of its motion can be seen by any one watching the machine, particularly in the absence of the chattering of the gears. All printing machines are necessarily still for changing of rolls and other purposes a portion of the time, but the whole production of this machine is over 33⅓ per cent. greater than that of the machines driven by steam. When it is considered that a print works plant is worth more than fifty thousand dollars per machine, the value of a device which will increase the output one-third is sufficient to introduce radical changes in this line of manufacturing.

Mr. Dunnell stated to me that his experience as shown by this trial has revealed such facts in regard to the capacity and capability of the electrical transmission of power for print works, that if one were to begin anew the construction of such works, he should advise instead of the numerous steam engines about the premises the generation of all the power at a central source, and its transmission throughout the establishment by electricity.

This use of motors for the operation of printing machines is the first practical instance of its kind, and its adoption and persistent and faithful trial confirms the enterprise of Mr. Dunnell, and also reflects great credit upon the practical skill of Mr. Sidney B. Paine, the manager of the mill power department of the General Electric Company, notwithstanding that his modesty prompts him to disclaim the whole solution of the problem in which he was the moving spirit, and asks for due credit for his able coadjutors.

The whole tendency of later invention in regard to electric motors appears to be in the successful use of large motors.

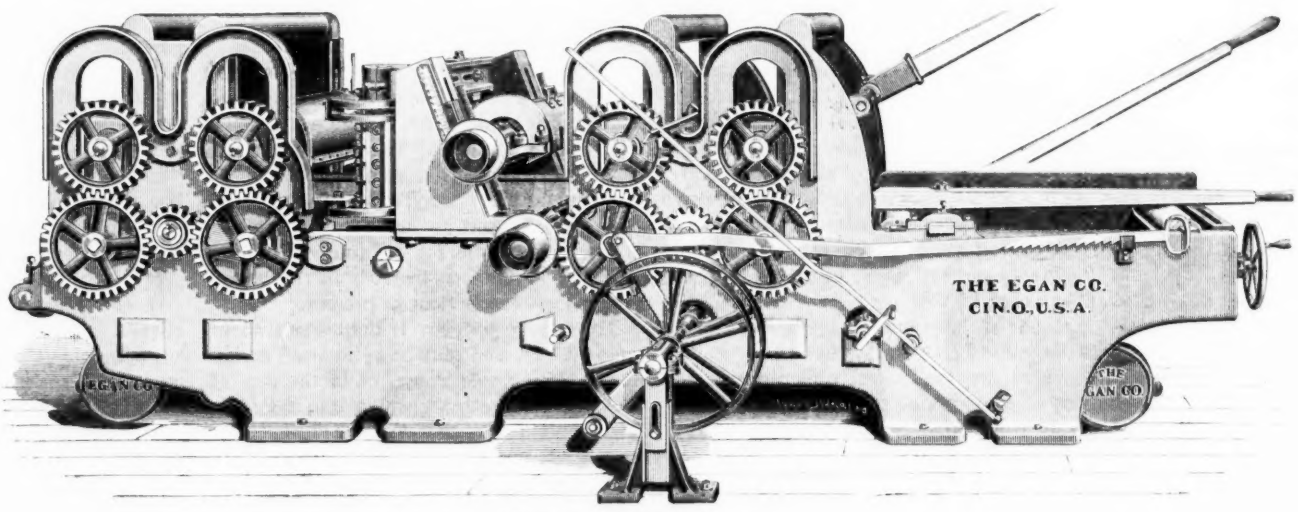
The Baltimore & Ohio Railroad are to use three 120-ton electric locomotives for carrying the trains in the tunnels under the city of Baltimore, being able in that manner to perform the same service in traction as with the largest locomotives, and without producing any smoke to interfere with the air in the tunnel. In connection with these locomotives is a supplementary motor, which produces an air pressure for the air brakes, and also for the whistle.

The advantages of electrical transmission of power are largely those of the relation of the position of the machinery with the motive power of the establishment. Each room is entirely independent of other rooms, and any motor is always ready for service as long as the machinery from which it derives its electricity is in operation.

Timber Dressing Machine.

The accompanying illustration is of an extra heavy timber dressing machine suitable for car sills, bridge timbers and dimension stock, etc. It is made to square up and dress on all four sides timbers up to 18 inches wide and 14 inches thick at one operation, having the capacity to reduce timbers as much as 2 inches at one cut.

The cylinders are made of solid steel, slotted on all four sides, with long journals, of large diameter. The two side heads can be removed by taking off the upper mandrel bearings. The lower cylinder is made to cut first giving a true surface for the timber to rest on the bed, and allows smooth work to be done by the main cylinder and side heads. The cylinders and side heads are supplied with chip breakers the full width of cut.



TIMBER DRESSING MACHINE.

The feed rolls, eight in number, are large in diameter, all driven by powerful gearing, four of them being placed before the lower cylinder and four after the side heads. All upper feed rolls are raised and lowered by power, also the main cylinder. The bed in front of the main cylinder is also raised and lowered by power, so that when taking a heavy cut half of the cut can be transferred to the lower cylinder by simply moving one lever.

The frame is very heavy, of neat design, and constructed to stand any amount of strain the machine may be put to, and the machine is believed to be thoroughly substantial and reliable, capable of continuously doing the very heaviest work of the class named. It is built by J. A. Fay & Egan Company, Cincinnati, O.

Paper Shields for Vise Jaws.

Those who have occasion to use "home-made" copper vise-shields—which includes about everybody that uses a vise—know that they are a first-rate article for disturbing one's equanimity. The "other one" is generally missing when wanted, they have an irritating habit of falling off the vise jaws, especially when a man is trying, alone, to engineer a heavy piece into position, and they get hard from use and are very likely not to get annealed until after they have damaged more or less work.

The Newark Machine Tool Works, Newark, N. J., have patented, in this country and in Europe, and are now manufacturing for the trade, vise shields calculated to remedy trouble in the directions above named. The shields proper are made of vulcanized paper; these are attached to malleable iron pieces that are provided with shoulders to catch over the vise jaws. The two pieces are connected by means of a modified form

of a U-shaped spring, so that when the vise is opened the operation of the spring is to keep them in place on the jaws. Every machinist will see their utility without further description. They are made for various sizes of vise jaws.

A Convenience for Draftsmen.

In the drafting room of the Hendey Machine Company, at Torrington, Conn., we noticed during a recent visit a device which seemed well calculated to save some wear and tear of the draftsman's nerve force, as well as of his tools. The accompanying engraving shows how it appeared on the table at the side of a drawing board, holding the various triangles, curves, protractors, small T-squares, etc., in such manner that the draftsman may not only readily see the article wanted, but as readily grasp it between thumb and finger, which is not the case where there is no regular place for the tools, and they are laid flat upon the table. The device is 10½" long, 5½" wide. The slots in which the tools are placed are about ⅛" wide and are spaced ¾" apart.

Horizontal Boring and Drilling Machine.

The accompanying illustration is of a horizontal boring and drilling machine, which is one of the smaller of six sizes of similar machine built by the Waterman Machine Tool Co., Providence, R. I.

The No. 1 horizontal boring and drilling machine differs from the engraving, in that the head is placed upon a lathe bed, and the table or carriage, on which is placed a smaller table for cross movement, can be moved along the bed in the manner of a lathe carriage by rack and pinion movement, and having also a vertical adjustment.

Automatic feed is provided in addition to quick hand movement. A projection on this carriage receives bushings for the outer end support of boring bar when the tool is used as a boring machine.

For general machine shop work, where small holes are to be drilled and bored parallel, and at fixed distances from each other, and when end milling, sawing, and various other jobs are to be done, this tool has met with much favor.

The other machines are all of the same general design as the cut, except that they are provided with power lift to the table. The main tables are made various lengths to suit the work, and are well adapted to the work of marine and stationary engine shops or wherever general machine shop work is done.

When desired it can be arranged to face both ends of a cylinder while it is being bored. The designating number of the machine indicates the size of the bar in inches except in the No. 1 and 2 machines, which have bars 2¼" and 2⅜" diameter respectively.

LETTERS FROM PRACTICAL MEN.

"Keep's Test" for Cast-iron.

Editor American Machinist:

I have read the admirable criticism of "Keep's Test," by Mr. Henning, in the AMERICAN MACHINIST of May 11.

His reputation in this line of work has caused him to be placed upon the international committee to formulate a system of standard tests for structural materials, and his opinions have great weight.

Whether founders will appreciate cast-iron testing is yet to be discovered.

Even if they can be convinced that it will save them money it will be difficult for them to realize that they must follow strictly a given routine to achieve success.

Ordinary founders cannot employ a special man to do their testing. The work must be done by the superintendent or by the foreman. These are busy men and can spend but a few moments at a testing machine. They want a quick and cheap process to arrive at conclusions without figures. They want strength, deflection, set, elasticity, shrinkage and chill in a form that they can see it.

I did not primarily construct this apparatus for scientific work, though it has revealed much that is useful. It is a practical thing for practical men. I devised this test simply to accomplish two things:

1st. To determine the influence of the ordinary substances found in cast iron, that the founder might be relieved of a needless fear that his pig-iron contained some injurious element.

2d. To enable an ordinary founder to know just what kind of castings his mixture of pig-iron would make, and to show him how to produce the very best castings from the very cheapest pig iron.

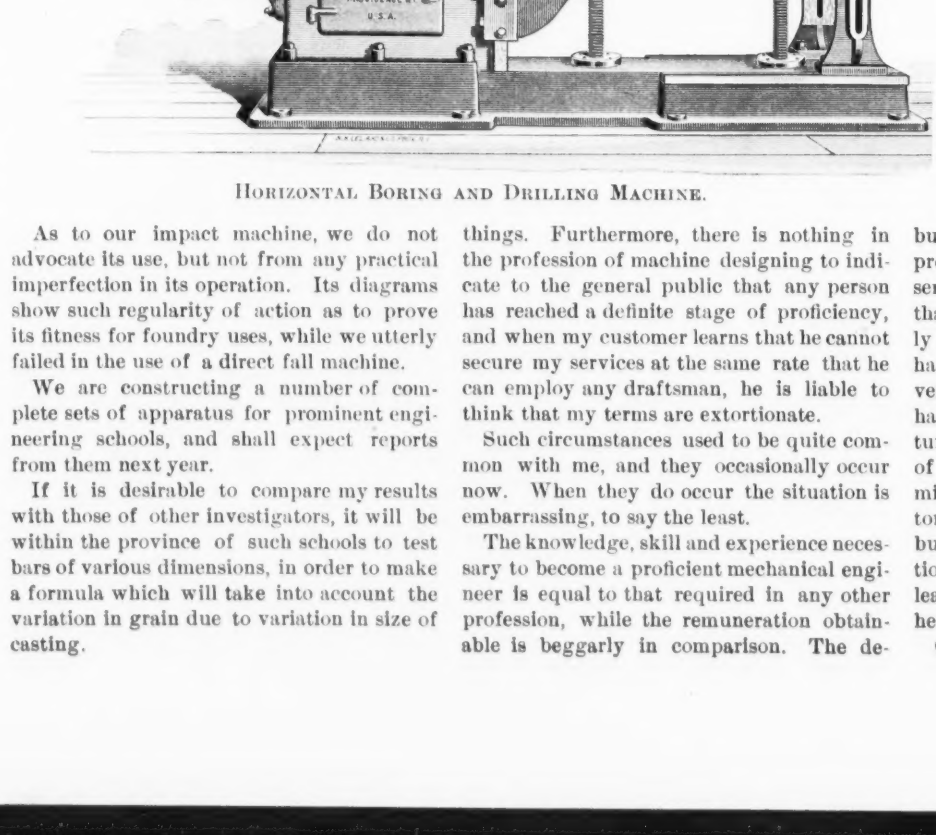
As to the size of test bar, there is no accepted standard size. If I had used a bar 1" x1"x12" Europeans would have favored 2x1x24 or some other size. Large bars are inconvenient to make, to handle and to preserve, are expensive and not sensitive enough to alterations in constitution.

A testing machine for general use must be low-priced and must be driven by hand. The range of this machine will test a half-inch bar of the strongest steel and will make a diagram of its own friction.

There are mechanical difficulties in the way of constructing such a single lever autographic machine for testing larger than a half-inch bar.

We have referred to what has been discovered by the use of these bars; if large bars would do as well, why have not these conclusions been reached by their use?

A CONVENIENCE FOR DRAFTSMEN.



HORIZONTAL BORING AND DRILLING MACHINE.

As to our impact machine, we do not advocate its use, but not from any practical imperfection in its operation. Its diagrams show such regularity of action as to prove its fitness for foundry uses, while we utterly failed in the use of a direct fall machine.

We are constructing a number of complete sets of apparatus for prominent engineering schools, and shall expect reports from them next year.

If it is desirable to compare my results with those of other investigators, it will be within the province of such schools to test bars of various dimensions, in order to make a formula which will take into account the variation in grain due to variation in size of casting.

But let it be remembered that shrinkage and chill are of as much account as strength. We are to-day answering a letter from one of the largest foundries in the country, that is using "Keep's Test," and writes:

"You can do the writer and this foundry a great service, by giving them some idea of the mixture you use to obtain remarkable shrinkage and strength. I would rather have your shrinkage than my strength, but if I can combine the two I want to do it."

Detroit, Mich. W. J. KEEP.

Standard of Qualifications for Mechanical Engineers.

Editor American Machinist:

I want to add my voice to that of Mr. H. F. J. Porter in favor of establishing some standard of qualification for the professional mechanical engineer. The want of such a standard degrades the whole profession to the level of any strolling individual who may style himself an engineer. I have for a long time felt the force of this condition of affairs, but more particularly in the beginning of my career than at present.

My own experience is doubtless that of many others, and may be epitomized as follows: My shingle hangs out in the city of Chicago. A customer walks into my office and wants, say, a new machine designed for a special purpose. Unless he previously knows me or has been especially recommended to me, he has absolutely no guarantee that I have any qualifications in this line, except that my sign indicates that I do such things. Furthermore, there is nothing in the profession of machine designing to indicate to the general public that any person has reached a definite stage of proficiency, and when my customer learns that he cannot secure my services at the same rate that he can employ any draftsman, he is liable to think that my terms are extortionate.

Such circumstances used to be quite common with me, and they occasionally occur now. When they do occur the situation is embarrassing, to say the least.

The knowledge, skill and experience necessary to become a proficient mechanical engineer is equal to that required in any other profession, while the remuneration obtainable is beggarly in comparison. The designer who is able to produce a new and successful machine on demand, certainly exercises an ability equal to that displayed by the architect who designs a building especially adapted for a particular purpose, and I venture to say that the grouping and arranging of the machinery in one of the buildings at the World's Fair required as much skill and ability as was required to produce the building itself.

Another thing; the machinery in Machinery Hall is the great thing. The building itself is merely the shell that covers the machinery. Every one knows who made the building, but who knows what brains produced the machinery? It is very much as if a man were known by the label of the tailor who made his clothes.

C. L. REDFIELD.

Patent Laws—Judge Speer's Decision.

Editor American Machinist:

I believe that our patent system is the corner stone of the foundation upon which has been built America's supremacy in the line of invention and labor-saving contrivance, and hence I am ever ready with a word in season or out of season on behalf of a true understanding of that system and its practical work.

This need not imply that I consider the law perfect. There are several points which in my judgment ought to suffer radical change, but they do not greatly affect the working of the statute as a whole.

Nearly all the mistakes made in this world may be traceable to misunderstanding or partial information. Hence Mr. Colvin's suggestion that the monopoly feature is the parent of all that misinformation considers to be the evils of the system, is due to partial information. The monopoly feature is a necessity in the case because the constitution provides that the grant shall be for the "exclusive" use. Congress may repeal the law or may make the grant for such time as it chooses, but if it authorizes any grant at all it must be an exclusive grant.

It is also a necessity in the case because, first, the demand for a new invention must always be created. People do not know anything about it, and hence are not asking for it. In fact when it has been made they must be convinced that they want it. Every man who has had anything to do with exploiting new inventions knows that therein is the battle. This costs money and it must be money invested and risked on business judgment. It makes no difference whether it belongs to the inventor or to a speculator, it is risked just the same, and it often amounts to many thousands of dollars before any return is obtained. The exclusive nature of the grant is a cool fact in the case. Another equally cool fact in the case is that no man, be he inventor or speculator, would put his money into the exploitation of a patent without an exclusive right, simply because just as soon as he has made the thing successful infringers drop in, and if they came in the guise of licensees he would simply find himself in the position of the cat who was used to remove the chestnuts from the fire.

When the inventor has obtained his patent he is at liberty to establish a royalty fee if he chooses, and let any one use who will pay the royalty. Many do this when the nature of the case renders it feasible and desirable; but it is impossible for the government to provide every patentee with good business sense along with his patent. It is notorious that a vast number of patentees were entirely successful business men. Some of these have amassed great fortunes from their inventions while thousands and thousands have made moderate or comfortable fortunes. These men did not need any coddling of government to protect them. The same might be said of a large majority of inventors if they had all been endowed with good business intelligence. If a valuable invention gets into the hands of speculators who leave the inventor out, it is simply because he failed to protect himself intelligently.

Canada at one time thought that by refus-

ing patents to citizens of the United States her people would get all the Yankee notions free, but experience taught her that very few inventions will travel of themselves, and very few persons will sink money in exploiting an invention which everybody may handle as soon as the market is made; so she gave up that plan and now invites the Yankee inventor to come over the border by permitting him to take a patent there a year after the United States patent has been granted.

If Mr. Colvin will look around on the many unpatented articles which are in the market on competition, he will find a very large proportion of them were patented some time or other and a demand then created, which, of course, did not expire with the patent.

It does not appear that Judge Speer directed the receiver to recognize and enter into formal contract with the Brotherhood of Locomotive Engineers, but merely directed the receiver to make contracts with the engineers, non-brotherhood and brotherhood men alike.

It is difficult to understand the persistent and widespread misstatements concerning this decision which is exactly the reverse of the claims generally made for it.

It is a maxim of the law that he who invokes equity must do so with clean hands, and the decision in the clothing men's case in New York was merely to the effect that the complainants had themselves done the thing complained of and had no rights in court.

If people would bear in mind that "the law is common sense," as said by Judge Gary in the Anarchist trial, and that men living in community only do so in compromise as to personal liberties, there would be less wonder when somebody finds himself restrained from damaging his neighbor.

R. D. O. SMITH.

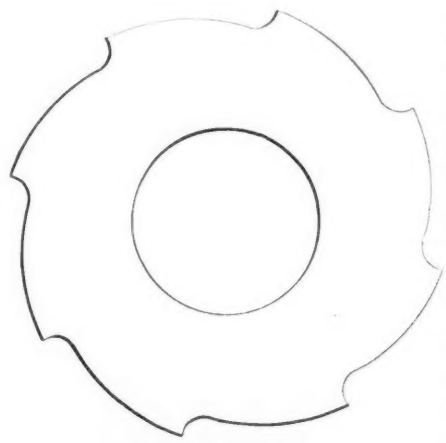
Books for Millwrights.

Editor American Machinist:

Noting in your issue of April 20th the query of C. W. P., Peabody, Mass., and your answer thereto, I would say that, while you have given the querist an answer, yet it is not one such as he needs, and judging from my own experiences in years gone by, I think it would be charitable for some of the advanced millwrights to offer him a few suggestions. Now, if C. W. P. had asked what mechanical work now published does not contain the most valuable and practical information on some branch of millwrighting, you might truly have answered with the one word—*none*. I have followed "millwrighting" since 1876 until its successor mechanical engineering began to assert its claims on the more progressive of the craft; then, with others, I was forced to either advance or recede, and since that time can find little fault with the reception of mechanical engineers by the world at large. Millwrighting is such an expansive trade that writers who would write a work covering the professional experiences of the craft could not do so for a lack of time to investigate so many different subjects. C. W. P. will have to be more specific. Does he want information on the construction of a New England paper mill, how fast to run a beater or washer or a paper machine? Does he want to equip a modern cotton-mill, placing therein a combined water and steam power plant of the greatest economic efficiency? Has he a contract to design, build and equip a modern machine works or manufacturing plant? Is the work immediately in hand the complete plans for and superintendence of a large flour-mill, with elevators, flour sheds, etc.? Does he want to build one of the old-fashioned overshot, breast, or undershot wheels? If he is seeking information on any specific line, he will have to procure the literature covering that branch.

Now, friend C. W. P., you are just where I was at one time, and with the hope of helping you, I will tell you how I helped myself. Learning that the mechanical world was running to specialties, I sought out the special literature adapted to my wants. Technical papers furnished me much valuable information on the methods employed in various manufactures, and by consulting the various catalogues of technical publishers, I have been enabled to make a judicious selection of their works, thus establishing a nucleus for a very complete mechanical library. While there is no one work that I have yet seen covering more than a partial scope of millwrighting, there is very little mechanical literature that will not afford some thought or idea to the careful and observant reader. Let C. W. P. adopt suggestions from the foregoing, and see if his experience does not follow mine. The more one learns, the more ignorant he finds himself, and the more reading matter he buys and uses, the more he wants. This is just my case, and I find difficulty in deciding between a new book and a new suit of clothes.

JAS. KNIGHT.



Screw Slot Saws.

Editor American Machinist:

In your issue of April 13th I noticed a very good article on metal slitting saws, by Mr. H. H. Hardinge. I have often wondered why different shops still cling to the old way of annealing and recutting saws when, if properly made, they could be ground when dull. For why should not a saw be ground as often as a lathe tool?

Annealing and recutting saws is a waste of time. The inconvenience of making them over and the short time that they would last led me to make a saw like the sketch, which sketch is from a saw I made two years ago, and is still in use doing the best of work.

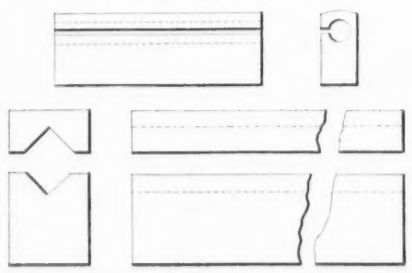
It cuts free and easy and will stand more feed than the fine toothed saws, and the teeth cannot break, or at least I have not been able to break any.

I have no authority why it should have more or less teeth, only that the fewer teeth the less time it takes to grind it.

A special machine for grinding these saws would be of great advantage, but I have had no trouble grinding them by hand. It makes no difference if the teeth are not all the same distance apart; it will cut just as well.

After using this form of saw for two years with best of results I would recommend it to any one for screw-slotting, etc.

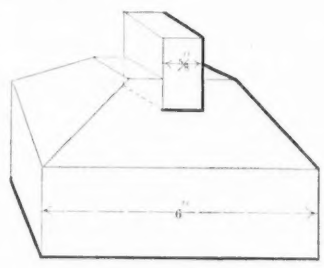
W. B. MURDOCK.



Lathe Tool Holders—Forging Block.

Editor American Machinist:

I forward two sketches of tool holders for lathe work which, in my opinion, have no equals for wide range of work and general excellence. I am using them constantly, and have done so for years. I have never seen either of them used elsewhere, and as far as I am concerned they are original, but I claim no especial merit. It doesn't take genius to produce such simple things—just plain, common sense. The hole through the small one is .25″; it is 3 inches long, hardened, and drawn to a purple. I find crescent ¼-inch wire rod all I can desire for the tools. The advantage of both holders lies in the fact that the tools can be adjusted in the holders so that they will project far enough forward of the holder to do the work whatever it may be, and no more, thus giving the stiffest possible boring tool under all conditions. The large one, as is obvious, will carry any shaped stock; round is the best, as it allows the operator to adjust it in any position for rake or clearance, and he is not dependent upon the skill and judgment or otherwise of the toolsmith whose ideas on the subject may differ from his, as is very often the case, to say nothing of the difference between the cost of forging boring tools out of rectangular stock, as is commonly done throughout the country, and the risk of burning, which is also very common. Now this idea should suggest itself to every good mechanic, and it doubtless has to some, or some modification of it, but I do know that it has not the general application to machine shop practice that it richly deserves. Either of them can be used to cut square threads of any pitch, and either right or left-hand, and is the simplest possible tool to make and use for outside threads and for inside threads. The same round stock can be used again to great advantage by boring a hole through several bars of different sizes and lengths on one end and inserting or driving in a cutter made of round wire, advantage being again taken of the principle of a round shank by enabling the rake to be given either way for right or left-hand threads. And right here I might say that a small boring or threading tool for small holders will give much better service after forging and closing the grain, than by making direct from the soft wire and hardening, and the only safe and satisfactory method I have found as yet for forging small tools from ¼ inch down is to have a strong gas flame like the one illustrated in a former issue, and a small, hardened steel block held in a larger block of cast-iron weighing several pounds, and driven in edgewise, the object being to present a narrow surface for



forging shank and turning point of such a small tool quickly as the heat radiates rapidly, and the flame and anvil must be close together.

H. HARDINGE.

Chicago, Ill.

Keep's Tests.

Editor American Machinist:

I have nothing to say to Mr. Henning's strictures on "Keep's Tests," published in your recent issue, except as an enthusiastic user of these tests. Mr. Henning's standing in the realm of accurate and uniform methods of testing is unassailable.

Taking his rather complimentary discussion of the Keep system in inverse order, if Mr. Henning will read carefully Mr. Keep's recommendations of his tests, he will find that he does not include his impact machine in the list of apparatus he recommends to those who are to use his tests; in fact, from personal correspondence with Mr. Keep, I am sure that he is as fully aware of the failings of his impact machine as of its merits.

The peculiar sizes of his bars make Keep's Tests necessarily unique. It is not intended that any results by Keep's Tests should be comparable with tests by any other method. Though Mr. Keep were to have adopted bars of a standard size, previously established by Barba, Bauschinger, Martens, Kirsch, as suggested by Mr. Henning, let me advise the latter that, unless these other authorities had their bars prepared in exactly the same way as prescribed by Mr. Keep, the results would be no more comparable than if these bars were, as at present, of different sizes. For instance, though all bars should be cast on their side with the corner down, as in Keep's Tests, if a gate were placed in the center of the length of the bar in any one case, the results as to strength from this case would be much inferior to those from others with gates elsewhere. Uniformity in method, it should be borne in mind, is fully as important as uniformity in size.

The above are as strong reasons for not attempting to make Keep's bars of the larger sizes adopted by others as the fact that the smaller bars are the more sensitive to changes in characteristics in the iron, yet I would emphasize the statement that it is a fact that smaller bars are more influenced by these changes than are larger ones. Mr. Keep is right. If Mr. Henning had a machine shop running piece-work with tools speeded 30–40 feet per minute on cast iron, and he was getting castings from an outside foundry and wished to make an inspection of these castings at the foundry to determine as to their hardness, would he examine first the fracture of a large section? No, he would break off a "fin" somewhere, and expect that any tendency to form a hard "skin" or hard spots would be indicated by the degree of whiteness found there. Again, if a small bar shrinks 0.15″ in 12″, and a larger or more massive bar only 0.1″ in 12″, I ask Mr. Henning to admit that for every unit tendency to shrink more or less the smaller bar will give the greater indication.

The same circumstance that induces greater shrinkage and greater chill in the smaller specimen also induces greater resistance per unit of cross-section to transverse or other fracture, and therefore, again, variations in structure of this cross-section due to different mixtures will have the greater effect on the smaller bar.

The circumstance referred to is simply that the smaller bar, in cooling the more rapidly, develops less carbon in the graphitic form, and is, therefore, whiter, harder, stronger, more dense and will shrink more than the larger bar. Moreover, idiosyncrasies of crystallization develop most in the bars the quickest cooled.

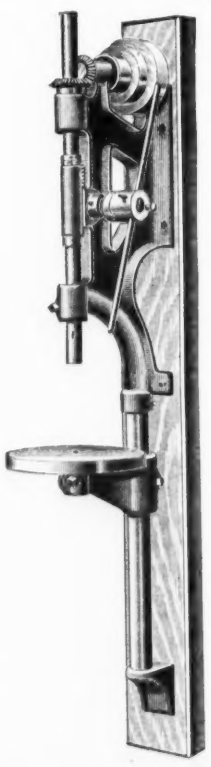
The happening that Mr. Keep is in the stove business does not affect the immense value of his tests to the man engaged in general foundry work.

E. H. MUMFORD.

Sixteen-inch Lever Post Drill.

The engraving with this represents a drilling machine made by the George Burnham Co., Worcester, Mass.

It will drill a ¾″ hole 5¼″ deep to the center of a 16″ circle. The spindle is steel and has a run of 5¼″. It is bored for Morse taper No. 1, but taper No. 2 will be put in the spindle when so desired.



The lever is adjustable to any position of the spindle, and is easily and quickly changed. The lever can be used its entire length or not as circumstances require.

The pinion gear that engages the rack is adjusted to the rack by means of eccentric bushings; these bushings serve the double purpose of taking up the wear, and, being cut through in the thinnest part, they give just enough friction to prevent the spindle from falling. The friction can be increased or diminished as circumstances seem to require; this device renders a counter-weight unnecessary.

The table is 11¾″ diameter and has a run up and down of 17″, giving a distance of 23″ between the spindle and table.

The machine is securely attached to a 3″ well-seasoned hard-wood plank, planed perfectly straight. The machine is then set up and the arm bored out by its own spindle. Complete counter-shaft goes with the drill. Weight, 225 pounds.

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NEW YORK, MAY 25, 1893.

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Let the Designations Mean Something

It has always been customary to designate lathes and planers by titles which have some significance. We have never heard of a manufacturer talking about his "No. 2" lathe or of his "No. 0" planer, and if one should so designate these machines, he would probably be boycotted by tool buyers and users who want the most possible information in the fewest words about machines which they propose to buy or use. Is it not somewhat curious then that a system of designating other machines has grown up which is just as inexcusable as this would be, and which is yet tolerated, and which machinists go on inflicting upon one another and upon outsiders by their catalogues, circulars, advertisements, etc.?

The terms "No. 4 milling machine" or "No. 3 screw machine," for instance, may mean much, and be very convenient for the manufacturers of these machines for their own use in the shop and drafting room; but to the outsider who is not familiar with these particular machines the terms mean just nothing at all until he has studied the catalogue or description of the machines, a study which helps him none whatever when he desires to know what the meaning of another manufacturer's similar terms may be.

But if a screw machine be designated thus: ½"x2", every mechanic will at once understand that the machine is designed to make screws up to ½" diameter and 2" long. A gear cutter called 30"x6" would be understood to be one capable of cutting gears 30" diameter and 6" face. An 8"x15" Universal milling machine would be understood to be one capable of taking upon its centers work 8" diameter and 15" long, while 8"x15"x10" plain milling machine would mean a machine capable of operating upon work of that size fixed upon the platen. It will be noticed that by this system the designation would in every case show at once the capacity of the machine, and by a little attention to the matter all the builders of machines of the same class could adopt the same system of nomenclature, and thus avoid much confusion.

In this connection we might mention that there is still room for improvement in the designation of sizes of lathes by including in them the length of work which can be turned on centers instead of the length of bed, the latter meaning nothing except by inference and more or less guess-work.

We believe no machinery builder can consistently find fault with our meaningless and senseless wire gauges, and at the same time defend the present system of designating machine tools other than lathes and planers.

The occasion of these remarks is the fact that the new edition of the Brown & Sharpe Mfg. Company's catalogue designates many of their tools by significant figures in addition to the designating numbers which have been used before, and we have been asked to express our opinion about it, which we are glad to do, for we believe the matter is of considerable importance.

Naval Construction and Maintenance.

The recent naval parade in New York, with the considerable stay of the various vessels that participated, was calculated to set people thinking about many things connected with the matter of modern navies. One of these is the length of time that is required for the construction of an efficient navy, one that shall amount to very much as navies go. For example, the United States has been rather vigorously at work for ten or twelve years, and although able to make a very creditable display, still, of course, every American knows the great superiority of the naval force of European countries, which did not, we believe through courtesy, send their heavy fighting ships to participate in the parade. If ten years, during which so much has been done, finds this country so far back in the list, how will it stand in twenty or thirty years? Probably not at the head, but from the present temper of the people, nearer the head than now, at the cost of a vast sum of money. But will the people remain in the present temper when the effect of this expenditure comes to be felt?

Again, naval vessels and guns soon become obsolete. It is not a question of wearing out, it is a question of being constantly superseded by the embodiment of modern ideas in naval construction. And this must constantly go on. The world is continuously engaged on the problem of making armor plates that cannot be pierced by modern projectiles, and in making guns against the projectiles from which no armor plate is invulnerable. It is the old problem slightly modified, of the irresistible force and the immovable mass. This and the desire if not the necessity of keeping near the head calls for ceaseless work in naval construction and the guns the vessels carry, a work that is farther from completion as the years go by.

It is easy to see the result of this; it simply means that the people who work in the production of things that enable mankind to exist, or to live more comfortably, must work the harder and fare poorer.

The men who produce the materials for great ships and great guns, and who make them and man them, must be fed and clothed, and the men who produce food and clothing must produce for these as well as for themselves. It means so much less of all that ought to be necessary because of the expenditure for what ought not to be necessary. This is as the moralizer reasons, but he reasons without producing any effect. We may—must—admit the truth of his reasoning, but the great nations will keep on building warships just the same, and maintaining great armies in idleness.

The people will have it the way it is. Nothing causes so much enthusiasm as a parade of the things and the means of causing death and destruction. This, so far as can be seen, will always be so, and so long as it is so nations will bankrupt themselves to keep abreast of other nations.

On the principle that a thing that is worth doing is worth doing well, Americans may feel pride in the display of American ships at the parade. To be sure we did not display the largest nor the swiftest vessels, but then we are comparatively new at the business. Time and experience are required. Time and experience and a good deal of money.

There is some satisfaction in believing that the skill and ability developed by a continual study of the problems involved in naval engineering and construction may be put to useful purposes in other directions; whether it is much or little there is doubtless something in this. Tools and machines and plans that are evolved for one purpose may be useful in other directions, and knowledge is something of wide application.

Since a navy must be maintained every one will believe in having a good one. It exercises a more civilizing effect than a poor one, and if either are of any use it is more useful. If the naval parade brought home to us more forcibly that we lacked something in speed, let more speed be the lesson of the day, and so with other things that may have been more strongly forced upon those who especially understand, or are supposed to understand such matters. We are in the way of making fighting machines just now and ought to make good ones or go out of the business.

Government to Take a Hand in Mining.

Hydraulic mining considered by itself has been a great success in some parts of California since it first came into use; but it had its drawbacks. The streams of water under great pressure were mighty potent in disintegrating hills and performing the work of excavation, but the debris was swept away to the destruction of property in farming lands and the obstruction of navigable streams. The result was that this kind of mining was practically put a stop to by the owners of land which was being made worse than a wilderness. This was done by injunctions restraining the mining companies. Various efforts have been made by mine owners to induce Congress to help them out of their troubles, the outcome being that such action has been finally taken as will provide for the construction of dams by the government to impound the destructive waste material so that mining may go on. We believe that the mine owners who engage in this sort of mining are to be in some way assessed to reimburse the government.

If the matter is so arranged that the people at large are not losers, either through paying for property destroyed or through constructing works to aid a few miners, it may be a good thing, notwithstanding the precedent of government aid. Hydraulic mining is a valuable industry that ought not to be abandoned if there is any satisfactory way to avoid it; the proposed plan seems to be about the only way to do so.

George B. Ewing.

George B. Ewing was killed by being struck by the tender of an engine at Madison Park station, Chicago, on May 8. He was waiting for a train to the World's Fair Grounds, where he had in charge the exhibits of Manning, Maxwell & Moore. Mr. Ewing was one of the best known commercial travelers in his line in the country. He had been in the employ of the firm named for ten years, and was very highly respected by all its members as a man of upright nature and perfect integrity as well as for other personal qualities. Mr. Ewing was born in Aberdeen, Scotland.

Literary Notes.

Messrs. John Wiley & Sons, 53 East Tenth street, are sending out complimentary copies of tables of circles and other specimen pages from Trautwine's civil engineers' pocket-book, sixteenth edition, 1893. The tables of circles are as complete as in the book, and they are known to be thoroughly reliable. We place a high value on these specimen pages, and no doubt all engineers who possess a copy will appreciate them as much as we do, for the simple reason that tables of this kind have to be referred to very frequently in every-day practice, and having them in as convenient a form as in the copy before us, much time is saved, and the cumbersomeness of handling a larger book avoided. Another great advantage of the tables in these specimen pages, is that it lengthens the time of usefulness of the pocket-book, of which we have now two copies on hand, whose value is much impaired on account of the figures in the tables of circles becoming obliterated by wear due to constant use, the other parts of books remaining nearly as good as new. Undoubtedly there are other persons who have had the same experience, and who will appreciate tables of this kind bound in separate covers.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(247) M. C. M., Kansas City, Mo., writes: Please inform us where chronometer governor valves are made. *A.*—We have made inquiries and failed to obtain the desired information.

(248) F. S., Yonkers, N. Y., writes: Please give me the title of a good book for brass molders, which contains also the mixtures for brass and kindred alloys. *A.*—"The Practical Brass and Iron Founders' Guide," by J. Larkin, may suit you.

(249) G. B. H., Carmi, Ill., writes: I have a great number of small portable engines to work on, and would be pleased to have you

give me receipt for case-hardening all kinds of work, such as bolts, links, etc. *A.*—See our issues of May 22 and June 5, 1890.

(250) G. W., Donald, Australia, asks: Does the gas in a balloon exhaust itself after being in the air for some time? *A.*—We presume that you wish to know whether the pressure of the gas will decrease in time. A decrease of pressure can occur only through leakage, or allowing the gas to escape. 2. Are hot air engines still in use? *A.*—Yes.

(251) G. A. G., Philadelphia, Pa., writes: Please describe a machine for testing the strength of cast-iron, one that is simple in construction, and which can be made very easily. *A.*—For simple machines see our issues of June 6, September 19, 1889; January 12, 19, current volume, and for machines of a more elaborate design, see our issues of May 30, 1889, and June 4, 1891.

(252) C. P., Hartford, Conn., asks: What length of time will be required to anneal malleable iron castings? *A.*—From two days to two weeks, according to bulk. Considerable experience in annealing is required as the castings must not be kept at too high a temperature, nor remain too long, or the result will be the opposite to what is desired—the castings will be hard instead of soft.

(253) H. J. J., Buffalo, N. Y., writes: In your issue of January 9, current volume, in Prof. Torrey's article on fly-wheels, at the bottom of column on page 10, it says: "This diagram was laid out as described in the AMERICAN MACHINIST for July 9, 1891." Wishing to look up the matter I sent for the paper, but find that I am as far from acquiring the desired knowledge as before, for this number has no such article, and makes no reference to any. Please give me the correct date. *A.*—August 20, 1891.

(254) E. E. S., New York, writes: Please inform me how many pounds of pressure will be required to punch a 1 inch square hole through iron 1 inch thick, both hot and cold. *A.*—The pressure will depend on the quality of the iron; at ordinary temperature a pressure of about 100 tons (2,000 pounds per ton) will be required to punch a hole 1 inch square through ordinary iron 1 inch thick. Iron at about a red heat will require a pressure of 25 to 50 per cent. less than the above, depending on the quality and temperature of the iron.

(255) A. B., Philadelphia, Pa., writes: Kindly inform me what horse-power can be obtained from a two cylinder single-acting steam engine; each cylinder is 2¼ inches bore, 2 inches stroke; steam pressure, 50 pounds; engine running at 500 revolutions per minute? *A.*—Non condensing engine, .8 horse-power. 2. What size boat will this engine drive? *A.*—Length, 16 feet; width, 4½ feet. 3. What should be the diameter and pitch of propeller? *A.*—Diameter, 10 inches; pitch, 18 inches. 4. What speed could be obtained? *A.*—From 6 to 7 miles per hour.

(256) J. B. S., Pittsburgh, Pa., writes: Kindly give name of work or works, and where to obtain it, giving general information relating to hydraulic machinery, valves, etc., such as are used in rolling-mills, etc. *A.*—Hydraulic Power and Hydraulic Machinery, by H. Robinson, may suit you. There are also cheaper works treating on this subject; these may be obtained from any dealer in scientific works; the addresses of some of these are given in our advertising columns. We should advise you to send to the dealers for catalogues which will enable you to make a suitable selection.

(257) W. B. R., Chestertown, Md., writes: Please inform me what harmful effect a steam jet placed in a chimney will have on the masonry. Do you know of any such cases where a draught is improved by this means? *A.*—It is generally considered that the steam jet will injure the mortar. We should always avoid putting a steam jet in the chimney as we do not consider it to be good practice, although there are a number of chimneys in which a steam jet is placed. We have in mind a chimney in which the steam was exhausted through a period of 30 years without any apparent injury to the chimney; but by these remarks we do not mean to advocate the practice.

(258) X. Y., ——, N. Y., writes: Kindly inform me of the way of finding the safe working pressure per square inch of a steam boiler. *A.*—The rule given by the Board of Supervising Inspectors of Steam Vessels is as follows: Multiply ⅛ of the lowest tensile strength found stamped on any plate in the cylindrical shell by the thickness in inches of thinnest plate in the same cylindrical shell, and divide the product by the radius in inches, the result will be the pressure allowable per square inch for single riveting, to which add 20 per cent. for double riveting. 2. Please give rule for computing the horse-power of an engine. *A.*—See answer to Question 25 in our issue of January 16, 1890.

(259) W. N. J., Providence, R. I., writes: Kindly answer the following questions: 1. What should be the size of steam ports for an engine cylinder 2½x3½ inches? *A.*—Width ¼; length 1 inch; exhaust ports ¼x1 inch 2. At what point of the stroke should the steam be cut off? *A.*—At about ⅞ of the stroke. 3. What should be the lap and lead? *A.*—Lap about ⅞ inch; lead 1/16 inch. 4. The engine is to be used in a steam launch. What should be the boiler pressure so as to run the boat 10 miles per hour? *A.*—That depends on the size of the boat and its lines. It is very doubtful whether you will obtain so high a speed. 5. What should be the size and pitch of screw? *A.*—For an engine of this size a propeller 18 inches diameter and 30 inches pitch is a suitable one.

(260) Student, ——, writes: I am taking a mechanical course at the college here and expect to graduate this year. I wish to become a marine engineer and hope to take that course at another college as a post graduate student. Can you tell me what kind of an opening there is for a college graduate in that line and also what the usual wages are? *A.*—Graduates generally enter the drawing room of a machine shop, but there are some who enter the shop so as to become familiar with the practical part of the business. You should have comparatively little or no difficulty in finding a suitable position, for, we have been informed by professors, that frequently the demand for bright and capable graduates exceeds the supply. The wages depend greatly on your own ability and industry.

(261) E. P. P., Dickey, Ga., asks: Will it be better to use two glass gauges in preference to one? *A.*—One glass gauge on each boiler is quite sufficient; indeed since there is always more or less danger of glass gauges breaking and injuring the fireman, we should not advise the use of two glass gauges. Every boiler should also have at least three gauge cocks, so that in case the glass gauge is broken the height of water in the boiler can always be determined. 2. Will glasses 16 inches long be more liable to break than those which are 12 inches long? *A.*—Yes. 3. Will heat discolor the nickel-plated work of glass gauges? *A.*—Heat alone will not discolor it much, if any. 4. What kind of wood is best to burn in a boiler oak or fat pine? *A.*—With careful firing there is practically little or no choice between the two; we should use that which is the cheapest.

(262) W. S. H., Morgantown, W. Va., writes: I wish to paint my steam pipes some bright color. Is there any paint that will not change color by heat? *A.*—We believe that either asbestos paint or graphite paint will suit your purpose. 2. Can bronze be put on hot iron satisfactorily? *A.*—Yes. 3. I am running an engine 14x20 with plain piston valves, whose steam pipe trembles a great deal when running with low steam pressure. What is the cause? *A.*—It may be due to condensation in the pipe. 4. When I stop the engine on either quarter with cylinder cocks closed it will move backward about 1½ inches. Is this due to too much lead or compression? *A.*—When the engine stops on a quarter, the piston is at about the center of its stroke; at this point there is no lead nor compression, and consequently the engine cannot be affected by them. The backward motion may be due to the tightness of the belt on the driving side, which in some cases, when stopping, tends to turn the pulley backwards until the difference in the tension of tight and slack side of the belt is somewhat reduced. This may be the cause in your engine, although we are not prepared to say so positively without examining the engine.

(263) A young one, Otford, England, writes: I have to attend to some two-throw pumps which work very badly and wear out the gearing very quickly. The depth of the well is 160 feet; the air vessel is at the top of the well; stroke of pump, 9 inches; diameter of barrel, 5 inches. I advised that the air vessel should have been fixed as near to the pump as possible, and ordered this to be done. In the meantime an old established firm who made the pump were consulted, and informed us that it is quite immaterial whether the air vessel is next to the pump or not, and that it is generally placed near the pump for convenience; consequently my order was countermanded, and was further sat upon by being told that the practical view agrees with theory. Who is right? *A.*—The information given by the manufacturers needs considerable modification. Although a foot or two in the position of the air chamber from the pump does not make any practical difference, the position is by no means a matter of convenience. On general principles the air chamber should be as close as possible to the pump, because when the air chamber is placed at too great a distance from the pump considerable time will be required to overcome the inertia of the volume of water between the pump and air chamber before the effects of the latter can be felt, and consequently the pump cannot work as smoothly as when the air chamber is placed near it. Of course, the unsatisfactory working may be largely due to the general design, of which you have said nothing.

(264) R. G. P., Delaware, Ohio, writes: Please explain how the quality of steam furnished by a boiler by means of a calorimeter is determined. Please explain its construction and theory, and rules for computing from the readings. *A.*—In our issue of September 17, 1887 you will find all the information you seek. 2. What should be the ratio of smoke stack area to grate area for stationary boiler? *A.*—The height of chimney, its form and the amount of coal burnt per hour will influence the area of the chimney. There are several formulas given for computing this area, but the results do not agree. Frequently the aim is to make the chimney area ½ to ⅛ of the grate area, but this ratio will give a chimney too small for small plants, but it is a good proportion for large plants. The best way, in our opinion, is to determine the amount of coal to be burnt per hour, and then refer to the table of chimney proportions in our issue of April 23, 1887, in which the height and diameter of chimneys for a given amount of coal burnt are given. 3. Is it possible to have the area of a chimney too large? *A.*—It is.

(265) J. R G, Richmond, Va., writes: Please give me a formula for computing the pressure of water against the walls of a reservoir 21 feet square and 21 feet deep. *A.*—The pressure on any surface immersed in a liquid of any kind to any depth is found by the following formula:

$$P = h \times a \times w,$$

in which P denotes the total pressure in pounds on the surface; h, the height from the center of gravity of the immersed surface to the free surface of the water in feet; w, the weight of a cubic foot of water in pounds, which we may assume to be 62.5 pounds; a, the area in square feet. In the example given we may assume the surfaces of the walls against which the water acts to be immersed surfaces; the area of each surface is $21 \times 21 = 441$ square feet; the center of gravity of each one of these surfaces is at one half the depth of the water, hence when the reservoir is full, the distance from the center of gravity to the free surface of the water will be 10.5 feet, and the total pressure on each wall will be $P = 10.5 \times 441 \times 62.5 = 289{,}406.25$ pounds.

(266) O. R., York, Pa., writes: I would like to have your advice in regard to the following: We have a contract to furnish a great many pipes (cast-iron), of these we must furnish not less than fifteen or twenty per day. The dimensions are, outside diameter 4 inches, inside diameter 3⅜ inches, length 9 feet. The pipes must stand 150 pounds water pressure, must be free from swells or other projections on the outside, as a scraper fitting the pipe must slide up and down the length of the pipe. You understand, of course, that these pipes are not to be turned, but used as the mold leaves them. Where they are now made, they are cast on end, but complaint is made of them, being swelled at the lower end. I would like to know how these pipes are poured on end, whether from the top or bottom, and if the molds are of dry or green sand with skin-dried surface, or are they cast in an ordinary mold. My idea is to incline the flask from 12 to 15 inches in its length, having a runner and riser (runner at lowest part) to about equalize one another, and have two in a flask. Kindly let me know your opinion of the best and quickest way to make and pour these pipes, and how to make the core boxes. Would it be necessary to have a pan to dry the cores in the mold, or would a straight plate and black sand be sufficient? *A.*—We referred these questions to S. Bolland, who replies as follows: In regular pipe foundries, plain straight pipes of the dimensions given are usually rammed in casings vertically, thoroughly dried, and cast from the top in the same position. When such pipes are swelled at the bottom, it is owing to the fact that the molds were only partially dried, or perhaps cast green. Whilst the vertical dry sand method is to be preferred always, it is possible to make sound pipes free from swells in green sand, if not less than 18 inches of incline be given to the flasks, the molds well rammed and most, if not all, of the iron poured from the upper end. To pour all the iron from the bottom would force the dullest metal to the part of least pressure, something always to be avoided by all means possible. The quickest method of molding such pipes in a horizontal position, either one or two in a flask, would be to withdraw a turned iron pattern or patterns, through a fixed match plate, using the plate for both cope and nowel, as explained in *The Iron Founder*. Cores on perforated tubes are to be preferred for all such work when it is desired to produce exact bores (see Core Making on Barrels in *The Iron Founder*). But if, for any reason, dry sand cores must be used, then in this particular case provide pans to insure a true circle free from fins in the bore.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's gears, Lex'n, Mass., & Phila., Pa. See p. 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

Air Hoists, Frank Richards, Box 3686, N. Y.

6-Spindle Turret Drills. A. O. Quint, Hartford, Ct.

Milling Machs. Kempsmith M. T Co., Mil., Wis.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St, N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings, Humphreys Foundry, Bellefontaine, O.

Air Compressors for every possible duty. Clayton Air Compressor Works, 43 Dey Street, N. Y.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th St., N.Y. Send for des'n

For the Latest Improved Diamond Prospecting Drill address the M. C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

"Pumping Machinery." New book, 450 pp, 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton Avenue, Philadelphia, Pa.

Builders Iron Foundry, Providence, R. I., Mortar Mounting, and 2 – 12" B. L. Rifled Mortars in front Govt Bldg., Chicago. Pamphlets on application.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

Passaic Art Casting Co., 35 Warren St., N. Y. Finest Castings in the world. Brass, German Silver, Aluminum, etc. Patent Pressure Process. Machinery Name Plates.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
111 Broadway, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us and mailed to any address at $1 00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Columbian Exposition Notes.

A serious accident, causing the death of one man and injuries to two others, occurred recently in Machinery Hall. The blind flange at the west end of the 16-inch exhibitors' header blew out, and the escaping steam scalded the three men, who were near by under the floor.

The flange was what is known as an *extra heavy* (stock) flange, calculated for 200 pounds steam pressure. Its outside diameter was 24 inches, and its central portion was 1 inch thick while the faced part was 1½ inches thick, the whole being reinforced by stout radial ribs. The flange was bolted to a 16"x16"x6" extra heavy tee by 20 ¾" bolts.

The break was peculiar. The entire central part of the flange blew out leaving the faced, annular portion undisturbed. As the pressure in the header was less than 125 pounds at the time, it is improbable that the steady pressure made the break, especially as no flaws of any sort could be found in the casting. It is generally supposed that a water-ram caused the trouble. Yet the header was drained carefully, and the pressure had been upon it for some time.

To effectually prevent another such accident, the "extra heavy" flanges will be re

placed with ones of very liberal dimensions. Further, instead of the cast-iron fittings along the line of the header being merely tapped by small pipes for draining, they will be replaced by others with water pockets of 8 inches diameter, from which the accumulating water will be carefully drained.

Machinery Hall compares very well with the other buildings in the progress of installation work. The German section is nearly in shape, and they will have their shafting and machines moving in a day or two.

The English are well along too. The Galloways engine is in running order, and it has just been connected to its countershaft, through which the line shafting for the English exhibit will be driven. Rope transmission is used on this engine.

The engine is of peculiar design. It has two cylinders, one high and one low. The low one is horizontal and the high lies on top of it looking down at an angle, and both connect to the same crank-pin. The condenser pump is direct connected to the low-pressure piston rod extended. The engine is designed in the plainest manner, and looks as if it was built for work.

In general the remainder of Machinery Hall is in fairly good shape. It would be in far better shape were the line shafting running. In the case of a large percentage of the exhibits, this is the one thing they lack of being complete. However, a large number of exhibits are not completely installed, and a very few spaces are not even taken possession of. Yet if hard work on the part of every one, both the Fair and the exhibitors, can do it, the work will be completed very soon.

Strength of Gear Teeth—A Correction.

In our issue of May 4, we published a paper by Wilfred Lewis, M. E., of Philadelphia, entitled "An Investigation of the Strength of Gear Teeth." Being republished from the printed transactions of the Engineers' Club of Philadelphia, before which the paper was read, it was not so carefully scanned as it would have been otherwise, because we assumed it had been already proof-read and thoroughly revised. Since our publication of it, however, we have received from Mr. Lewis a letter in regard to it, from which we quote as follows:

There is a slight typographical error, which I did not discover until after my reprints were issued, in the nomenclature preceding equation (5).

"n = actual number of teeth" is correct, but "n = secant α" is manifestly absurd and is not what I intended, as the illustration clearly shows. The value of N, as I wrote it and expected it to appear, was "N = formative number of teeth, = n secant α, or the number corresponding to the radius R."

Though the error is not likely to seriously mislead those familiar with the subject, we think it best to correct it, and so save possible annoyance to readers.

Lacked the Sign Manual.

The inventor and manufacturer of a standard article which has been on the market for many years, recently brought suit against an infringer, and in the course of the litigation his counsel offered the original patent papers in evidence, when the counsel for the defendants promptly objected to the submission of any such paper as pertinent to the case, denying that the document was a patent as alleged by the plaintiffs, because it lacked the signature of the Secretary of the Interior.

This omission of signature proved a fatal defect in the further prosecution of the case, and the owner had held the patent for years, believing that it was a complete document. The opinion has been given that the defect cannot be remedied, except by special act of congress, and that even in case of such special legislation the protection could apply only from the date of the act to the termination of the present presumptive patent.

It has been alleged that patents and other official papers are "shingled" on desks and tables, and some faithful deputies, whose services survive mutations of political tides, show the officials where to sign their names in the proper place.

It may be that the advice generally printed, and so rarely followed, on insurance policies, "Read your policy," might also be in place on original patent papers.

The Ancient and the Modern Gun.

An engineer, after visiting the caravel "Santa Maria," remarked that the little guns of that vessel were silent witnesses as to the limited advance in the science of ordnance, but bore potent testimony of the advance in the mechanic art. "Here," said the engineer, "is a built-up, breech-loading gun; it has a central tube, on which jackets are shrunk (or forced) in short sections; at the joints between these sections there are other iron bands, tightly shrunk. The breech block, which is chambered, contains the cartridge; it is held in place by a key (or wedge). This gun is certified to be a *fac simile* of those actually used by Columbus on board the 'Santa Maria.'

"The difference between this gun and those now being built, and about which we read such interesting accounts, differs in magnitude, not in principle. The molecular strain in a forging or casting of great size led to the abandonment of cast guns and the adoption of built-up guns in our own generation; it seems evident that as the cupolas advanced in size and the molders' art progressed, the cast guns of large size became practicable; but with the increased internal pressures demanded the castings reached their limit, and built-up guns became essential.

"The gun of to-day is composed of a central tube, on which are shrunk 'hoops' in shorter sections; its breech block is held in place by a slotted screw, which is but another form of the wedge, being a circular inclined plane.

"The difference between the gun of Columbus' ships and those of to day is due almost exclusively to the mechanic arts; to the steam engine as the power; furnaces, the cupolas, the hammers and the lathes as the tools, and to the brawny sons of toil who work these machines; the advance has been gradual, and is wrought by mechanics and draftsmen, and the claim that gunnery or that ordnance belongs to the occult science pales before the scrutiny of common sense observation."

MANUFACTURES.

The Kingsley Foundry Company, of Hammond, Ind., has been incorporated, with $23,000 capital.

The Gogebic Furnace Company has been formed by Irving M. Bean and others at Milwaukee, Wis.

The Crane & Breed Manufacturing Company, of Cincinnati, O., is increasing the capacity of its foundry.

The Gem City Manufacturing Co. has incorporated at Erie, Pa., to manufacture motors, clutches, pulleys, etc.

M. F. Caldwell and others have organized a company for the erection of engine works at Knoxville, Tenn.

The Friction Pulley and Machine Company, of Sandy Hill, N. Y., has begun the erection of a new engine house.

The Brooklyn (N. Y.) Tube Bending Co. has been formed; capital, $8,000. Directors, E. E. Tucker and A. Hounslea.

The Eureka Emery Wheel Company, of Buffalo, N. Y., has been chartered, to manufacture hardware, etc., with $25,000.

The New England Steel Works, of Worcester, Mass., are to make an addition 50x50 feet to their steel casting foundry.

The Columbia Engine Co., of Chicago, are building shops at St. Charles, Ill., to manufacture the Columbia hot air engine.

The Withrow-Breeden Hardware Manufacturing Company, of Neosho, Mo., has been organized by J. M. Withrow and others.

There has been organized in Allentown, Pa., the Lehigh Steel and Iron Co., capital $250,000, to manufacture steel or iron.

In Philadelphia, Pa., the Peerless Foundry Co., capital $10,000, has formed. Incorporators, Geo. W. Hopkins and Harry Kaper.

The Sheridan Steel and Wheel Company has been incorporated at Wheeling, W. Va., with $50,000 capital, by P. J. Green and others.

The National Metal and Electrical Company, capital, $25,000, has been formed in Cleveland, O., by Leonard W. Bradely and others.

The increase of capital stock of $300,000 made by the Shelby (O.) Steel Tube Company will be used for the purpose of enlarging the plant.

The Hecla Manufacturing Co., lately formed in Chicago, with a capital stock of $150,000, will locate its factory at Utica Highland, Ill.

The Hooven & Rentschler Foundry Company at East Hamilton, O., will make an addition to its present foundry of a structure 100x100.

The Peerless Foundry Company, of Philadelphia, Pa., has been chartered, to manufacture hardware specialties. Among the incorporators are John F. Dinan and Henry Preston.

The Bessemer Iron and Development Company has been organized at Llano, Texas, by G. C. Schryver and others, of San Francisco, Cal. The capital stock is placed at $3,000,000.

The Parkersburg (W. Va.) Engine and Foundry Works have been formed, with $20,000 capital, to manufacture engines, boilers, machinery, etc. J. G. McClure and others are interested.

The Buffalo (N. Y.) Oiler and Packer Company has been organized, to manufacture machines for oiling and packing car-axles or other machinery. Capital, $25,000, and directors, William H. Wright and others.

The Fayette Foundry and Machine Company has been organized in Montgomery, W. Va., with $50,000 capital, for the purpose of manufacturing machinery, castings, etc. Henry Davis, W. R. Manfin and others are connected.

The Globe Plating Company is the name of a company that has recently gone into the electric plating and polishing business on Winter street, Worcester, Mass. E. M. Hammond is proprietor and George C. Palmer manager.

The Williams Manufacturing Company was recently organized at Portland, Me., with William L. Freeze as president, and H. L. Williams treasurer and general manager. The company will carry on a general woodworking business.

The Livingstone Manufacturing Company has recently been incorporated in Rockland, Me., with a capital of $9,000, for the purpose of manufacturing tools. C. W. Livingstone being superintendent, and G. H. Blethen, business manager.

At Philadelphia, Pa., work has been begun on a $40,000 plant for Clarke & O'Neill, damask tablecloth manufacturers. Five buildings are to be erected with 181 feet, and a 345-foot extension back. The firm will employ about 300 operatives.

The woodenware manufacturing establishment at Enfield, Me., in which Eugene M. Hersey, of Bangor, is largely interested, is being greatly enlarged. An extension of the mill is being built and other new buildings are in process of construction.

The Lodge & Davis Machine Tool Co., Cincinnati, O., have just received a large order from Sr. Angelo Seradeo Gomes, Ambriz, West Coast of Africa, for lathes, planers, drills, shapers, etc., to be used in the manufacture and repair of sugar machinery.

The Northwestern Car and Machine Company, of Detroit, Mich., with a capital of $500,000, of which $360,000 has been paid in, has been duly formed with R. P. de la Ronde as president; F. A. Anderson, secretary and superintendent. The plant will be ready for operation July 1.

William Wilkins, of Greenville, S. C., is organizing a $250,000 company to build a cotton factory in Greenville County about 1½ miles from Marietta. Mr. Wilkins proposes to have a plant of 10,000 spindles and 300 looms, the latest and best improved machinery being installed.

Varney & Nutting is the name of a new firm just formed at Skowhegan, Me., for the manufacture of caskets, as a specialty, and chamber sets and other furniture generally. They have a part of the M. J. Allen woodworking building at present and have started in with every prospect of success.

The Falcon Tin plate and Sheet-iron Company of Niles, O., has been formed, with a capital stock of $300,000. The organization will be practically the same as that of the Falcon Iron and Nail Company, and the proposed plant will have a capacity of 10,000 tons of finished light plate and sheet-iron per annum.

Capitalists have formed the Courtenay Manufacturing Company, for the purpose of erecting a cotton factory on Little River, in Oconee County, S. C. The company is composed of Hon. W. A. Courtenay, F. J. Pelzer, W. B. Whaley, J. C. Cary, W. A. Hayward and R. G. Rheet. The capital stock is placed at $150,000.

The Hartford and Weather Street Railway Co., of Hartford, Conn., is about to increase its equipment by five new cars. Its present electrical equipment consists of twelve cars. The new cars will have an equipment of two 20 horse-power motors. The Worcester Street Railway Co. is also going to increase its equipment by six cars, each car to have two 25 horse-power motors.

The C. G. Sterns Co., of Bangor, Me., are making extensive improvements on their lumber mills. They will tear down their present gang-mill and fifty feet to the north, thus affording greater wharfage facilities than at present, and will erect a new building, 56x72 feet, to be equipped with two band mills and a complete outfit of modern machinery.

Ranger Bros., of East Wilton, Me., have been in Dover, Me., recently prospecting for the location of a mill for the manufacture of basswood into sleigh and carriage panels and dashers, also veneering and all kinds of wide, thin lumber. They report the outlook as good, and there is but little doubt this industry will be located there in the near future.

There is water works agitation at Suffield, Conn.; Los Angeles, Cal.; South Bend, Ind; Woodbury, N. J.; Buffalo, N. Y.; Terre Haute, Ind.; Seattle, Wash.; Centralia, Ill.; Medford, Mass; Troy, N. Y; Galveston, Tex.; Lemars, Ia.; New London, Conn.; Tipton, Ind.; New Bedford, Mass.; Rome, N. Y.; Millvale, Pa.; Rochester, Ind; Mt. Vernon Barracks, Ala.; Trenton, N. J.; Bangor, Me.; Philadelphia, Pa.; Harbine, Kan.

Gisholt Machine Co., Madison, Wis., has issued a very interesting and instructive catalogue of turret lathes, tool grinders, etc. Perhaps the most instructive feature of the catalogue is the illustration of a large number of pieces and parts of various kinds of machinery made on their lathes, in many instances the time required in the making being given. Every one interested in turret machine work, large or small, will do well to study this catalogue, which is very fully and finely illustrated and printed.

The Stirling Company, 74 Cortlandt street, manufacturers of water-tube boilers, have recently closed the following orders: Cleveland Cable Railway Company, 750 horse power; Lehigh Valley Traction Company, 900 horse-power; Whitman & Barens, for their new Chicago works, 1,000 horse-power; Elmira Knitting-mills, 50 horse-power. They are also installing a large plant for the Union Passenger Railway Company, New York City, and for the Lindell avenue road, St. Louis, Mo., the latter plant being for 2,600 horse-power. The New York office is in charge of Frederick A. Scheffler.

An enterprise of importance to Lewiston, Me., is in contemplation. The Lincoln Mill, after being idle for nine years, is now, it is understood, to be utilized. Negotiations have for some time been pending between the proprietors of the Cumberland Mill and the Franklin Company, the latter corporation being the owners of the Lincoln Mill. The Lincoln Mill property consists of upwards of 100,000 square feet of land, a large brick mill, and upwards of 700 horse-power, good for day and night use. The old cotton machinery has been removed. It is the intention of the purchasers to use a part of the Lincoln Mill for woolens.

Work will soon be commenced on the new mill to be built by the Wing Bros., at Old Town, Me. They have lately purchased of Harry Powers the mill near the toll bridge at Orono, and will operate it this season. This mill was originally a match factory. Some of the present machinery will be used and a large amount of new added. Between twelve and fifteen men will be employed at Orono, and about twenty in their mill at Old Town when completed. The two mills in connection will give added and better facilities for planing and turning off the large amount of work enjoyed by this firm in the manufacture of all kinds of house finish.

Machinists' Supplies and Iron.

NEW YORK, May 20, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.25; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $14.25 to $14.50 for No. 1 Foundry; $13 to $14 for No. 2 and $12 to $13 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10¼c. to 10⅜c.; Cookson's, 10½c. to 10¾c.; Hallett's, 9.90c. to 10c., and U. S. French Star, 10½c.

Copper—Lake Copper is still quoted at 11c., but offerings are more restricted and the demand continues slow. Casting Copper is held at 10½c to 10¾c.

Lead—There is no important change in the market, 3.85c. is bid and 3¾c. asked. The indications seem to point towards an advance.

Lard Oil—Prime City is quoted at 85c. to 86c.

Spelter—The market is firm, 4.30c. to 4.35c. is asked for New York delivery. It is claimed that some business was done at 4.25c., but the demand is slow.

Tin—The market is improving, prices are slightly easier, and the movement is quite active in moderate lots at 19.85c. for spot, 19.90c. to 20c. for May and 20.10c. for July.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Draftsman with good shop exp. desires pos.; machine tools, engs. & gen. mach'y. Steady, AM. MACH.

Wanted—Position as draftsman; boiler work specialty; some exp. in pump work. Box 125, AM. MACH.

Mech. draftsman, with several years' experience, desires position. Address Box 123, AM. MACHINIST.

Draftsman (designer), mach. tools, jigs, fixtures, general mach'y, desires pos. H. M., AM. MACH.

Wanted—Six 1st-class machinists. Apply Toledo, Ann Arbor & Nth. Mich. Ry., Owosso, Mich.

Wanted—Lathe, planer and vise hands. A. L. Ide & Son, Springfield, Ill.

Mech. draftsman, age 26, 12 years' shop and drawing-room experience, wants position. Refs. Box 132, AMERICAN MACHINIST.

(*Continued on page* 11.)

Wanted—Foremanship; engines, pumps or general jobbing. Indicator, AMERICAN MACHINIST.

Wanted—1st-class machinists, molders & pattern makers. Munro, Spiro & Wendler, Carthage, N. Y.

Wanted—Wood pattern makers, accustomed to eng. & mach. work; must be accurate. State exp. and wages. Hogan Boiler Co., Middletown, N. Y.

Wanted—A 1st-class foreman for machine shop. One experienced in saw-mill work. The McArdle & Sinclair Mfg. Co., New Orleans, La.

Wanted—Steady position by a first-class pattern maker; competent to take charge of shop. Address Pattern Maker, 220 Ruggles St., Boston, Mass.

Machinist, tool and die maker, used to making special machinery and e perimental work, wishes situation in country. Box 127, AM. MACHINIST.

Wanted—Position as draftsman. Have had tech. education, 3 years' machine shop practice, and 2½ years as draftsman; age, 24. W. L. S., AM. MACH.

Wanted—Two or three first class machinists; general hands preferred. 115 Plymouth St., Jersey City, N. J.

Mech. draftsman desires situation (American); 6 years' exp. on machine tools and gen. machinery; practical. Box 130, AMERICAN MACHINIST.

First-class machinist and tool maker, 15 years' exp., wants situation on small work in New York City or vicinity. Box 131, AMERICAN MACHINIST.

Wanted—Permanent position by good mech. draftsman in or near New York. Tech. education and shop practice. Address Box "Y," AM. MACH.

Mechanical engineer with large exp. in structural iron work & mechanical engineer'g, wishes position as draftsman or sup't. Box 128, AM. MACHINIST.

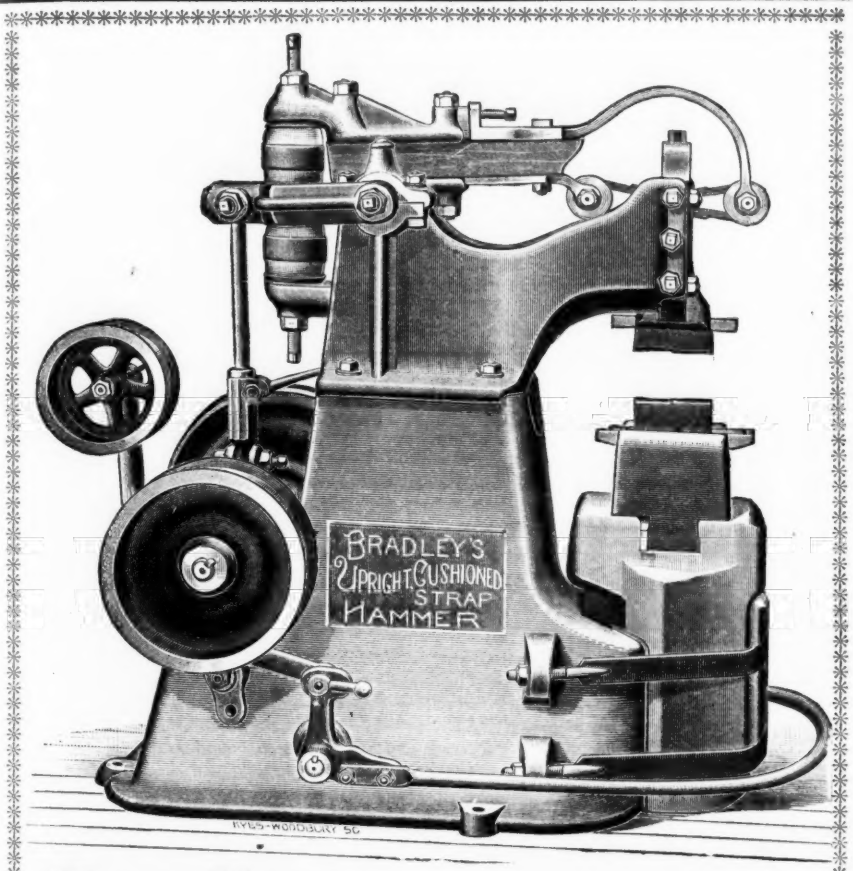
A mech. draftsman, Cornell grad., with exp in drafting, mach. shop pract., erect'g & test'g auto. engines, desires position. Box 129, AM. MACHINIST

City or country. Expert helpers furnished without charge, for carpenters, wood carvers, and wood turners. Small pay acceptable at start. Address 225 E. 9th street, New York City.

Wanted—Day engineer in Brooklyn, N. Y., to run seven days each week; $28; must be familiar with modern steam appliances and electric lighting. Address Box 133, AMERICAN MACHINIST.

Machinists, Contractors, Builders, etc.—An energetic, reliable man, thoroughly familiar with accounts and routine of office in all departments of general machine plant, is open for engagem't; fully able to handle & superintend men, keep time, etc.; best references. J. C. Reynolds, 323 Canal st., N. Y.

(Continued on page 12.)



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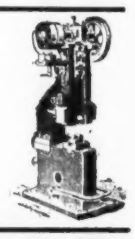

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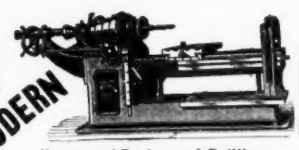

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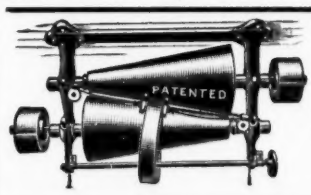

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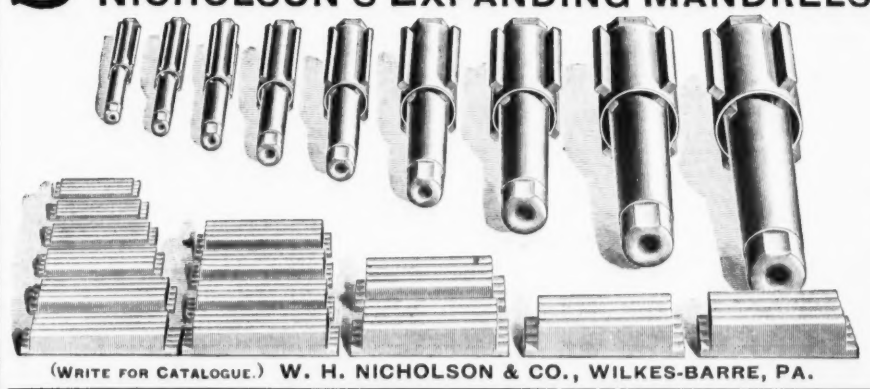

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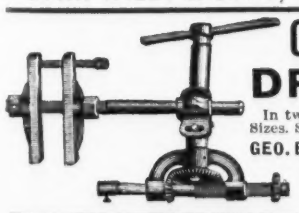

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Heat and Expansion of Water. Vapor in Water, Air and Steam.
Evaporation—Escape of Vapor. Condensation. On the Vacuum.

ELECTRICITY.

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MISCELLANEOUS TABLES.

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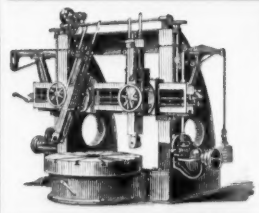

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Wanted—A young man with exp. in mech. drawing, to work under instructions of mech. eng., as ass't draftsman. Address, giving ref., and stating exp., and salary expected, Box 119, AM. MACH.

Wanted—1st-class vise and floor hands of large experience; must be sober and industrious. Can secure steady employment. Married men preferred. Morgan Engineering Co., Alliance, Ohio.

Wanted—Position as foreman in iron foundry; experience twenty years; age 40; holding similar position in a first-class jobbing shop at present; references furnished. Address Box 104, AM. MACH.

Wanted—Pos. as manager or superintendent by a hustler, capable of handling men and business, who wishes to change from present position and locality. Address Hustle, Box 112, AM. MACH.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd,.O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Will sell 19-foot launch and 3x4 marine engine cheap for cash. Address C. G. Sauls, Columbus, Ga.

Screw-cutting lathes, 26", 28", 30" swing, $375 each; other large tools cheap. 229, AM. MACH.

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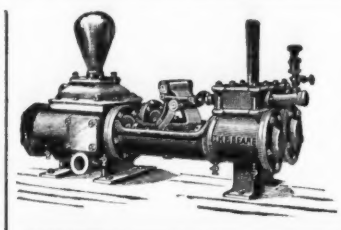

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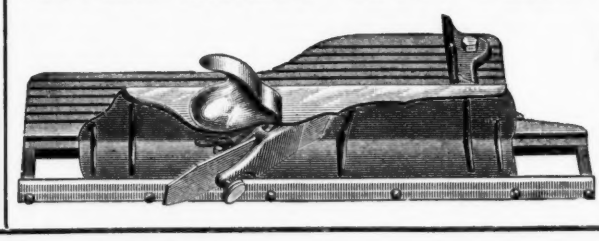

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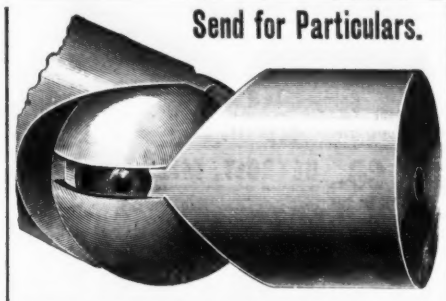

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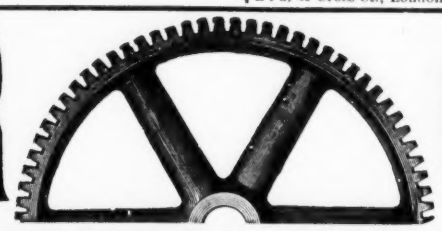

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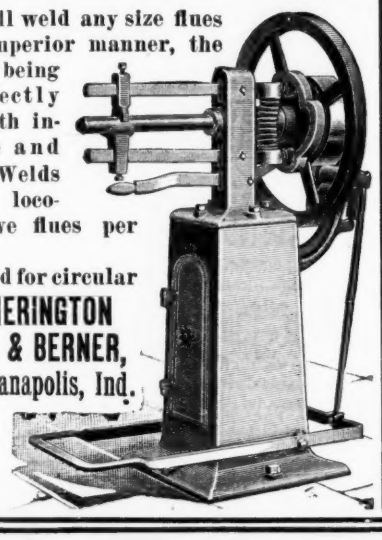

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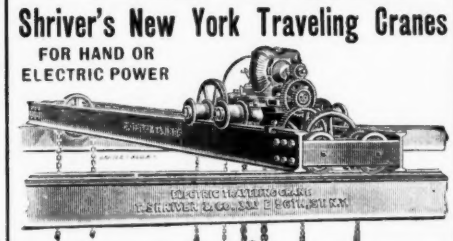

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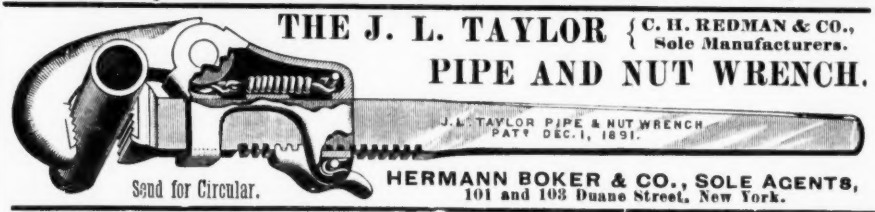

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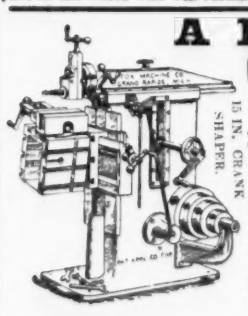

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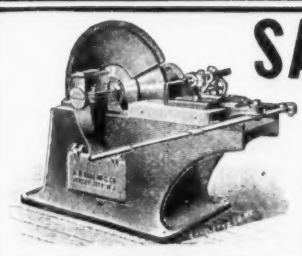

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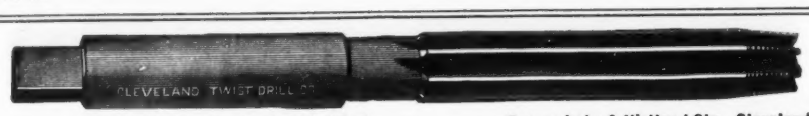

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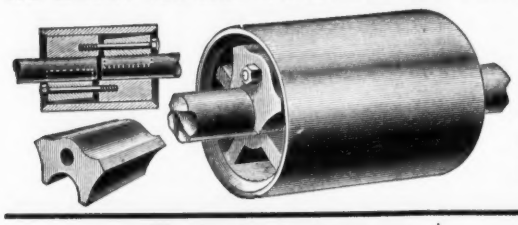

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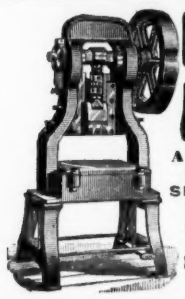

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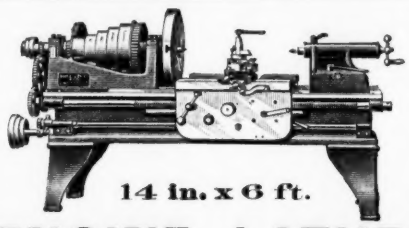

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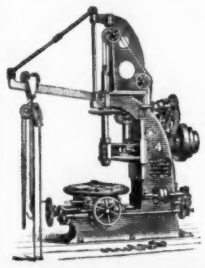

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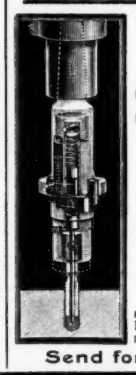

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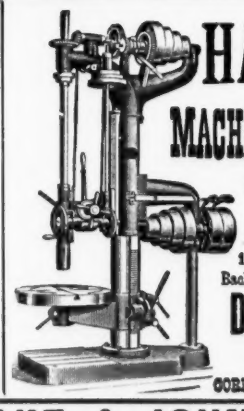

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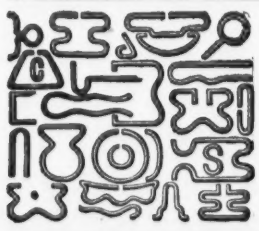

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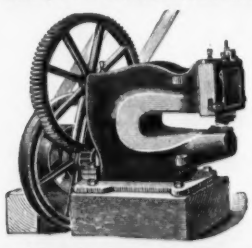

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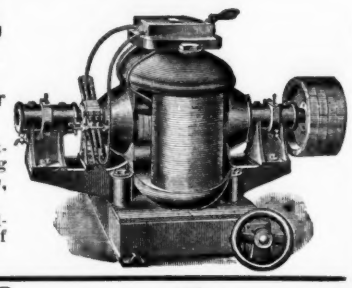

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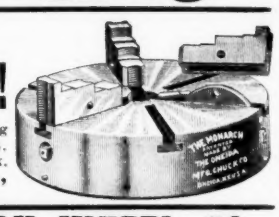

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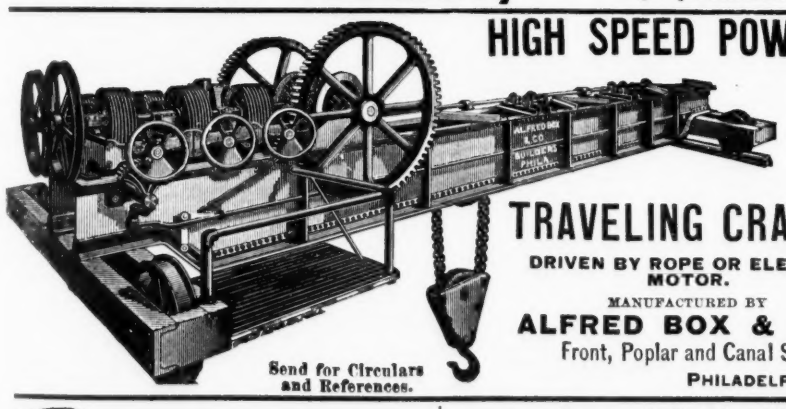

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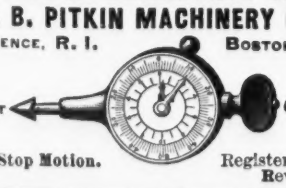

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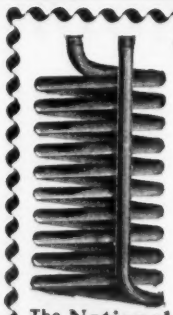

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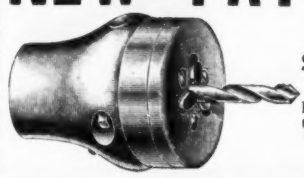

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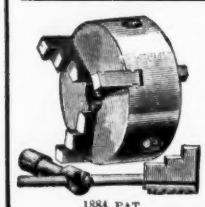

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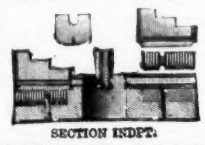

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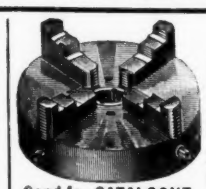

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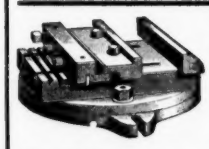

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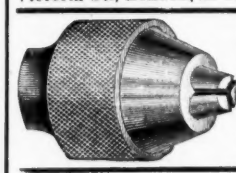

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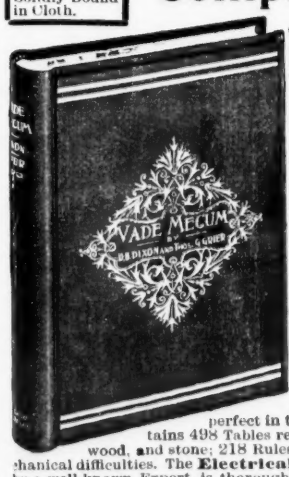

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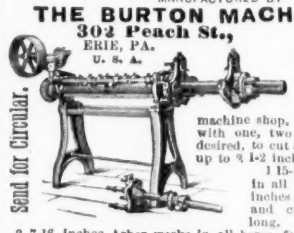

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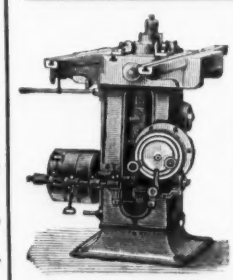

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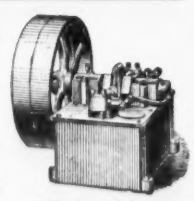

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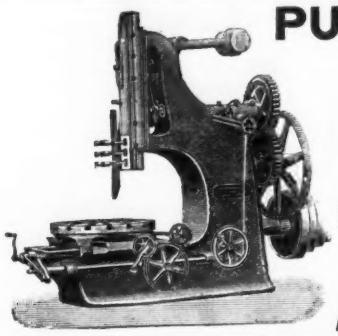

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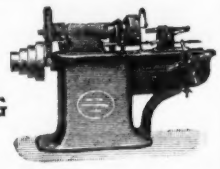

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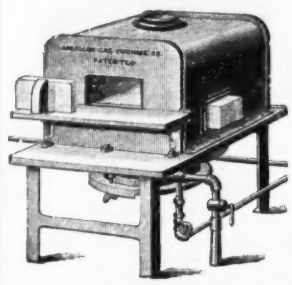

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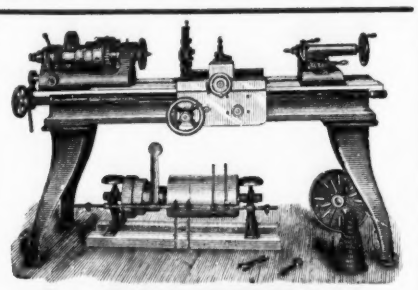

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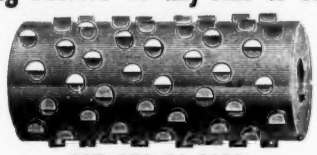

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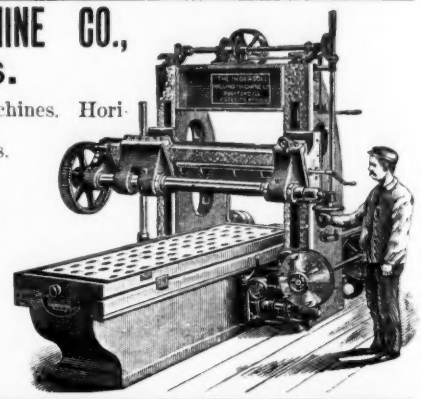

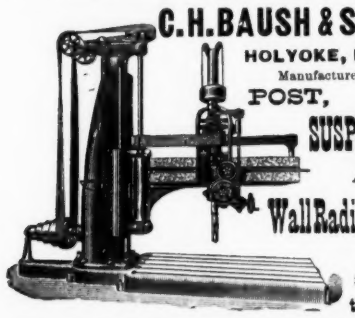

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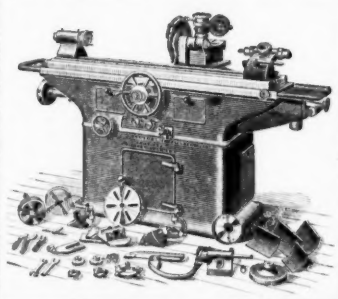

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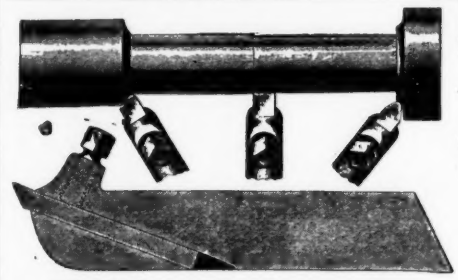

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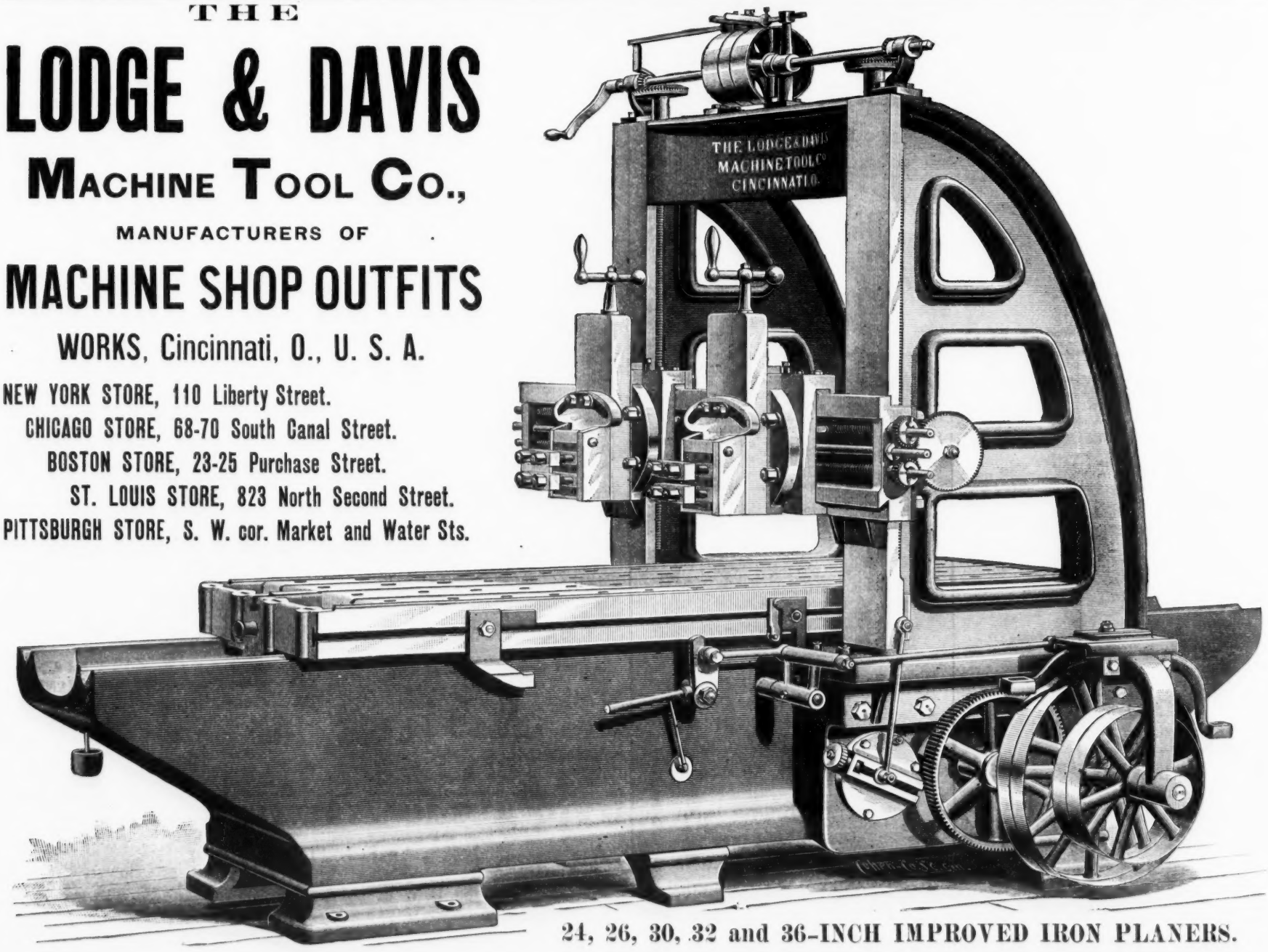

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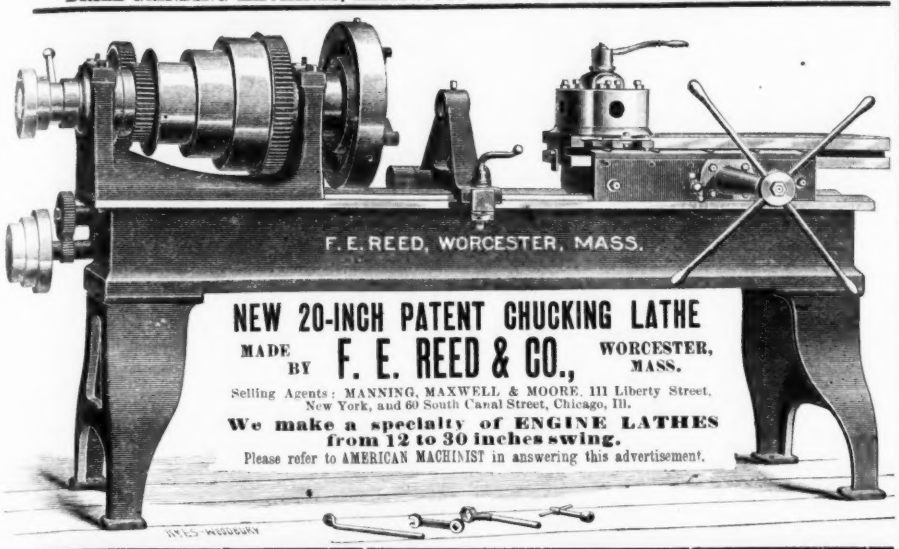

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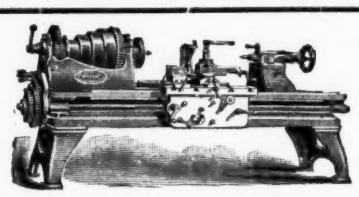

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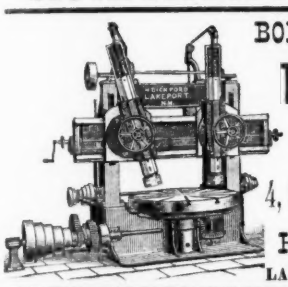

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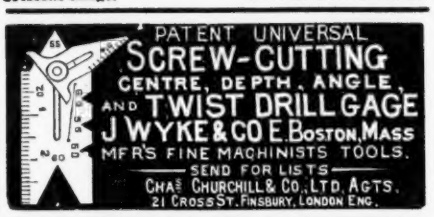

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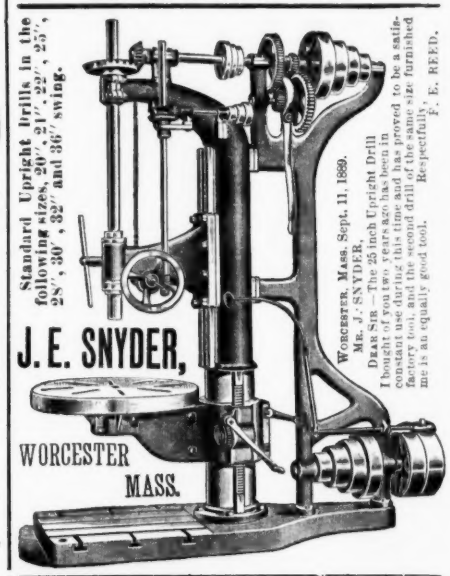

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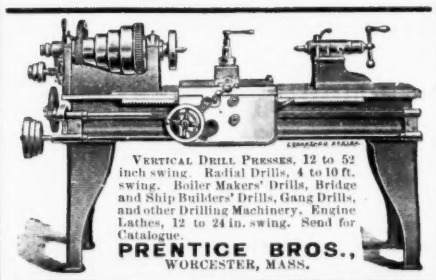

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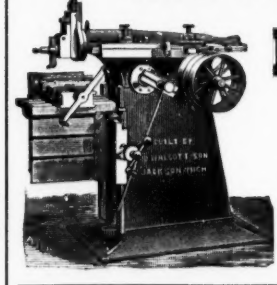

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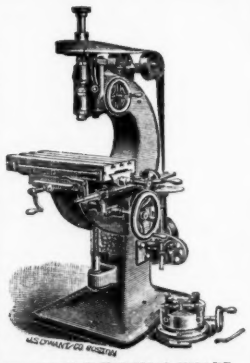

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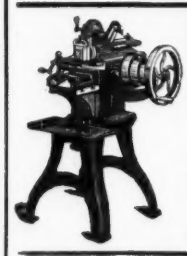

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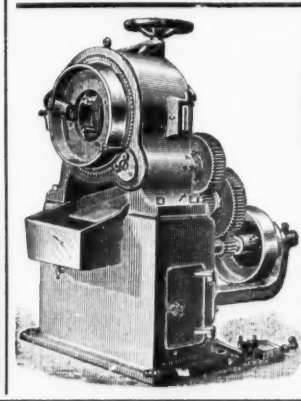

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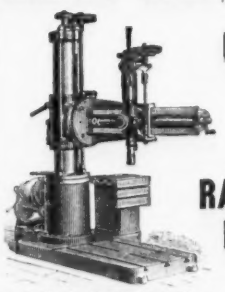

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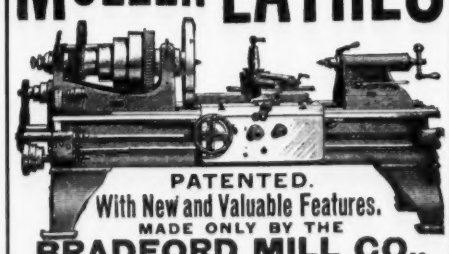

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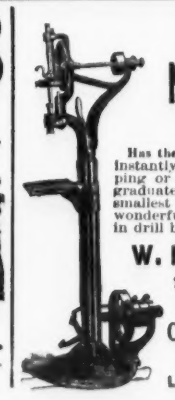

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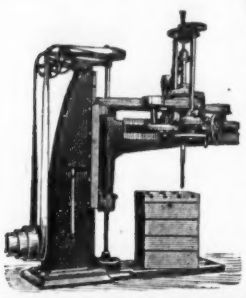

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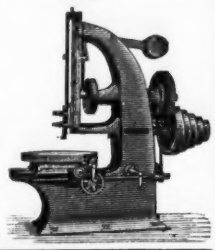

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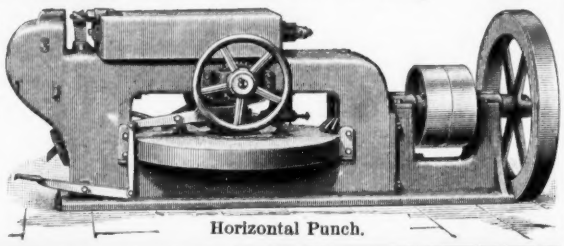

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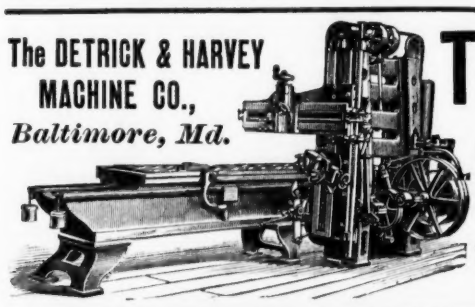

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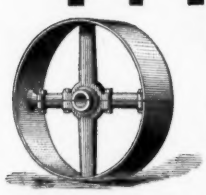

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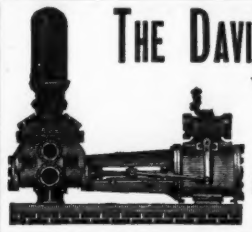

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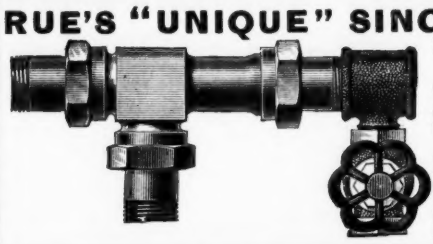

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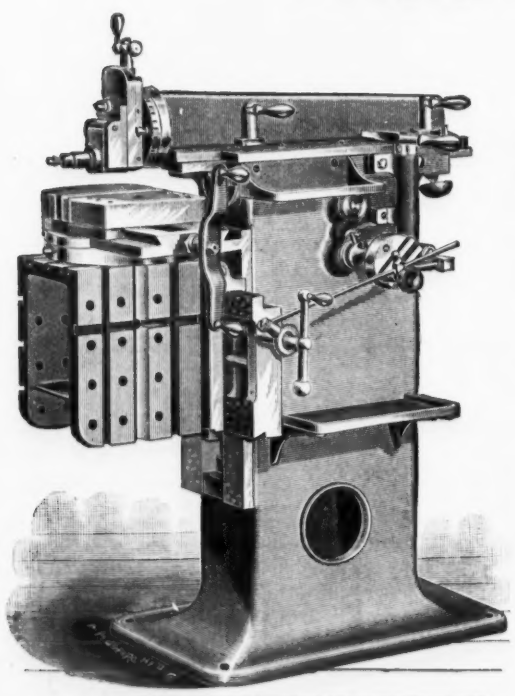

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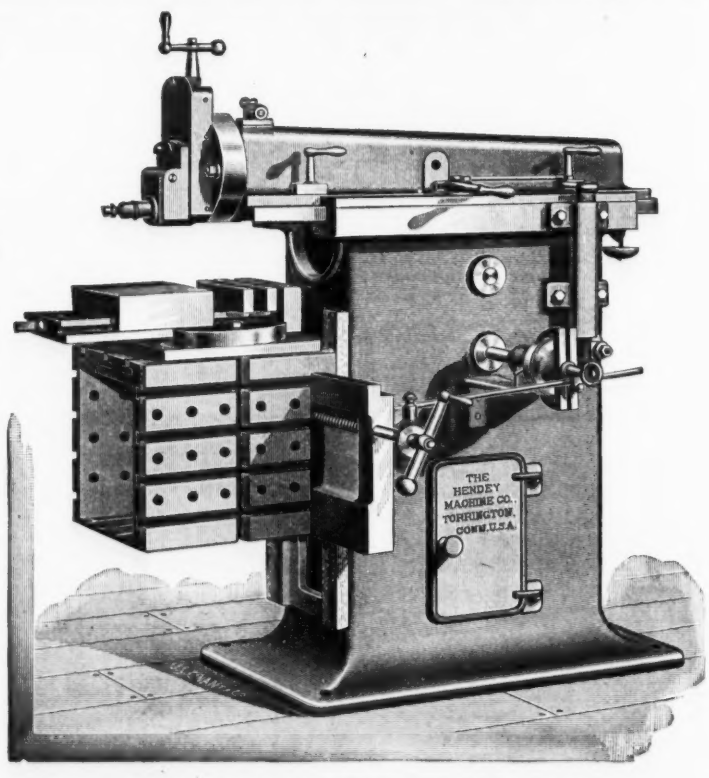

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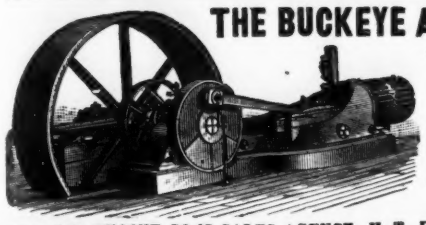

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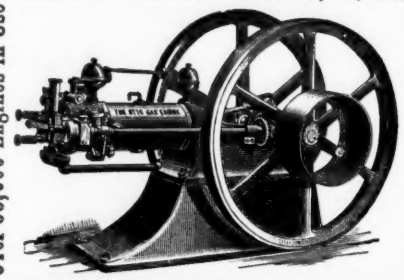

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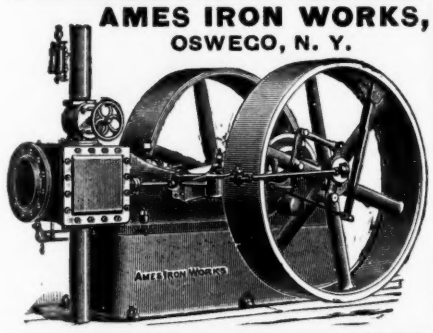

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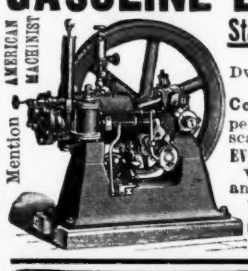

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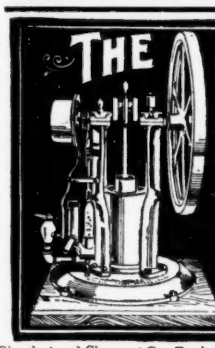

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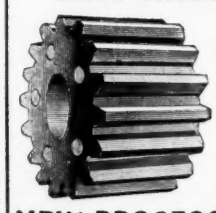

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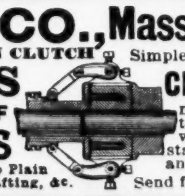

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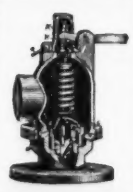

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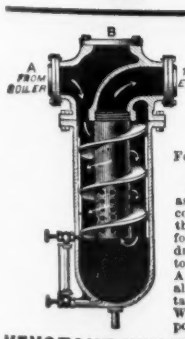

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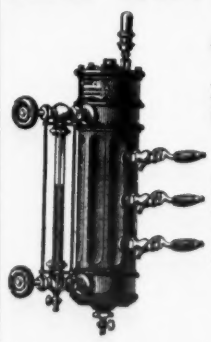

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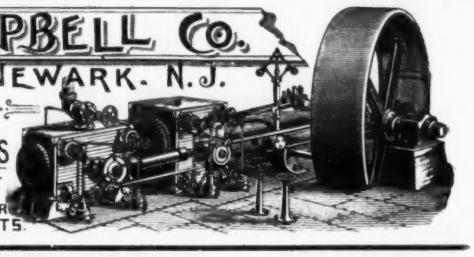

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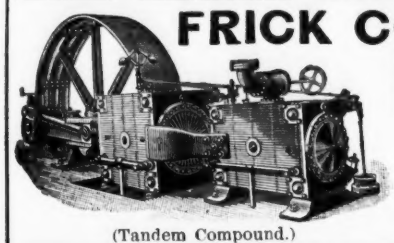

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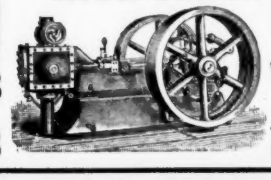

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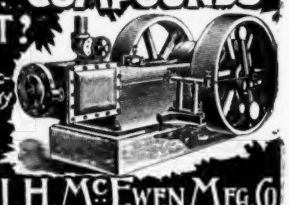

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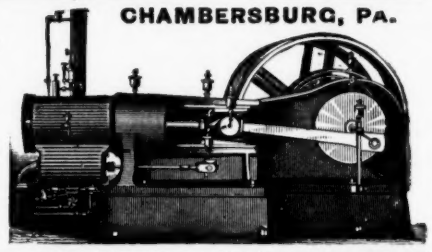

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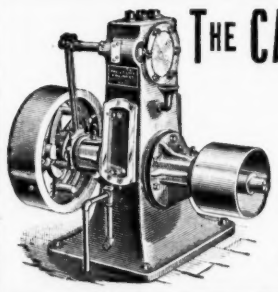

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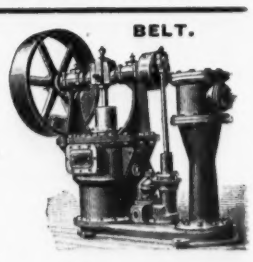

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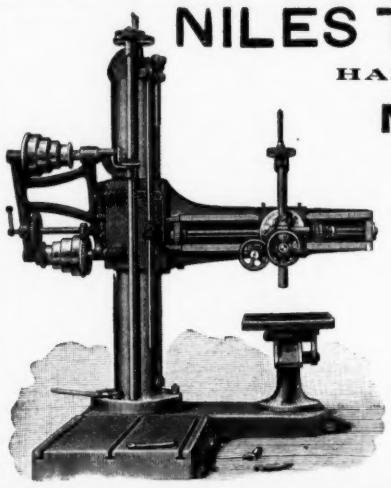

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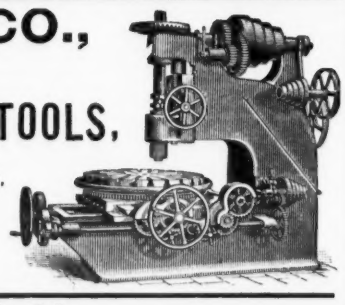

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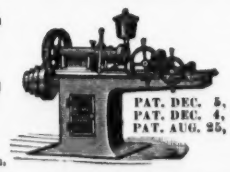

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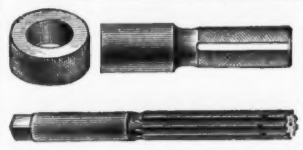

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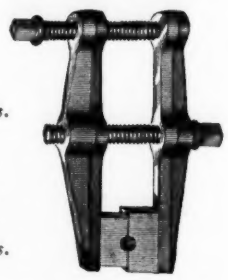

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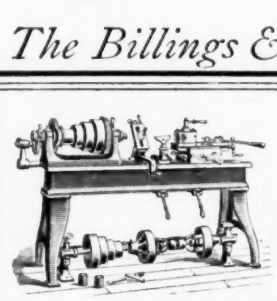

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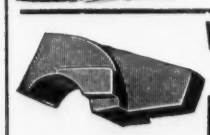

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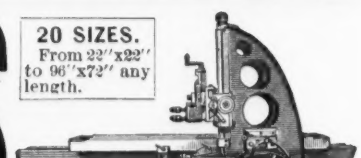

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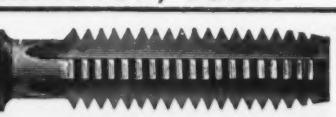

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